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SMOKELESS AIR

JOURNAL OF THE
NATIONAL SOCIETY FOR CLEAN AIR

No. 107 · AUTUMN 1958 · 2/-

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Smoke Control Areas—Progress Report ✦ London Fog of December, 1957 ✦ Commons Debates on Scheduled Processes and Smoke from Ships ✦ What Gladstone said in 1864 ✦ Damage to Books, &c. by Impure Air ✦ Clean Air Act in Scotland

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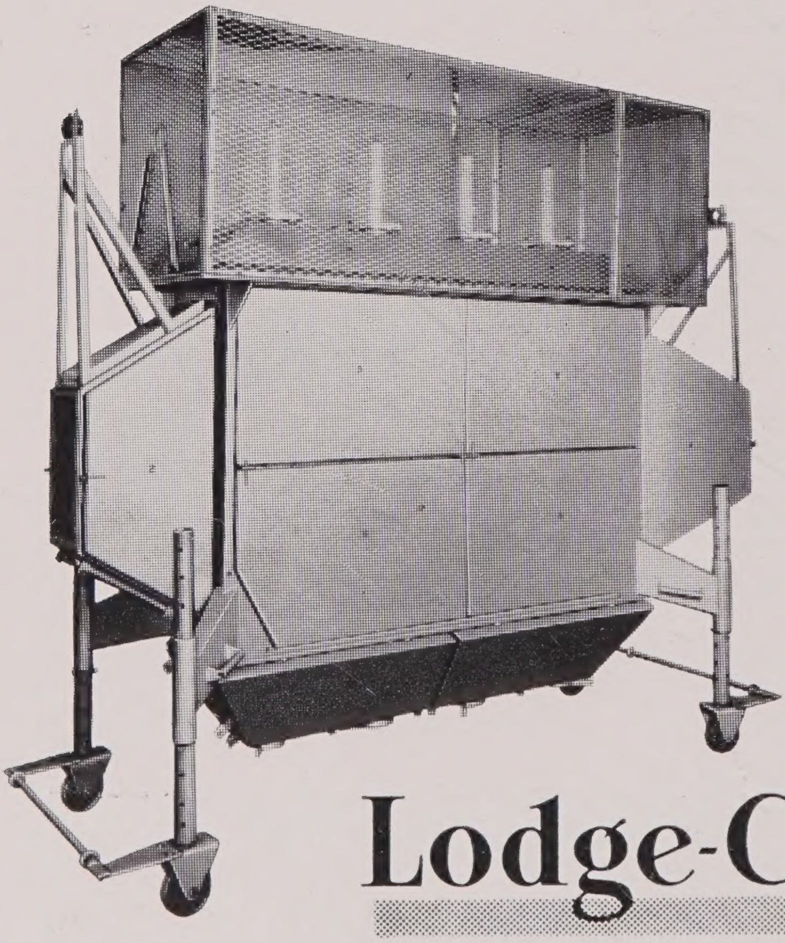

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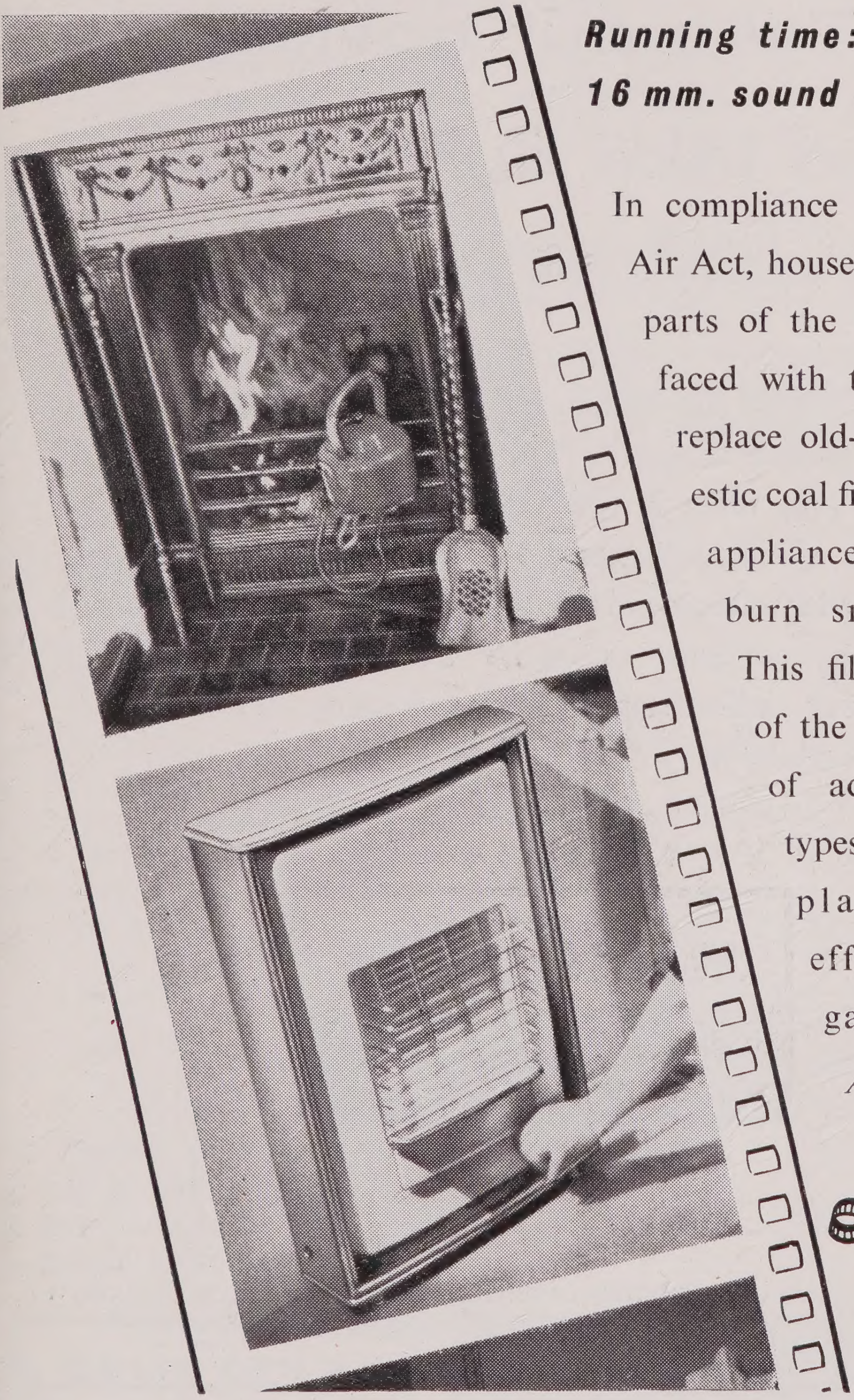

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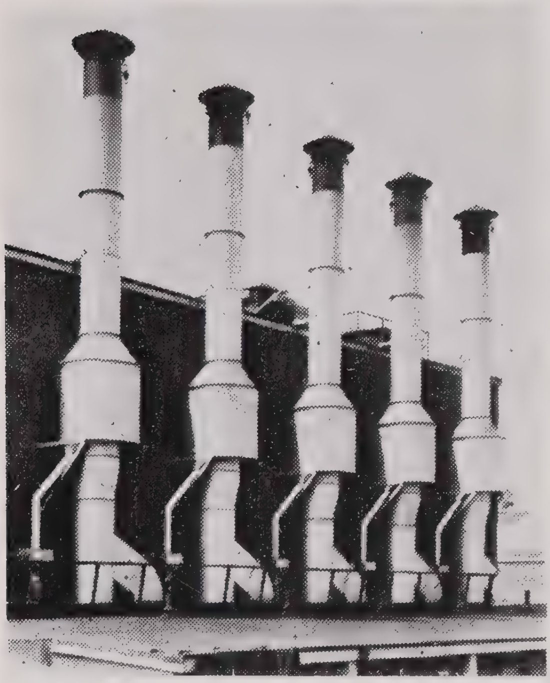

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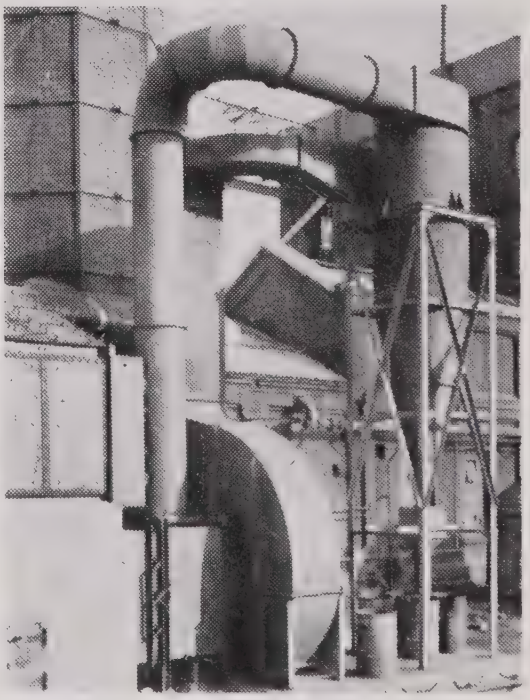

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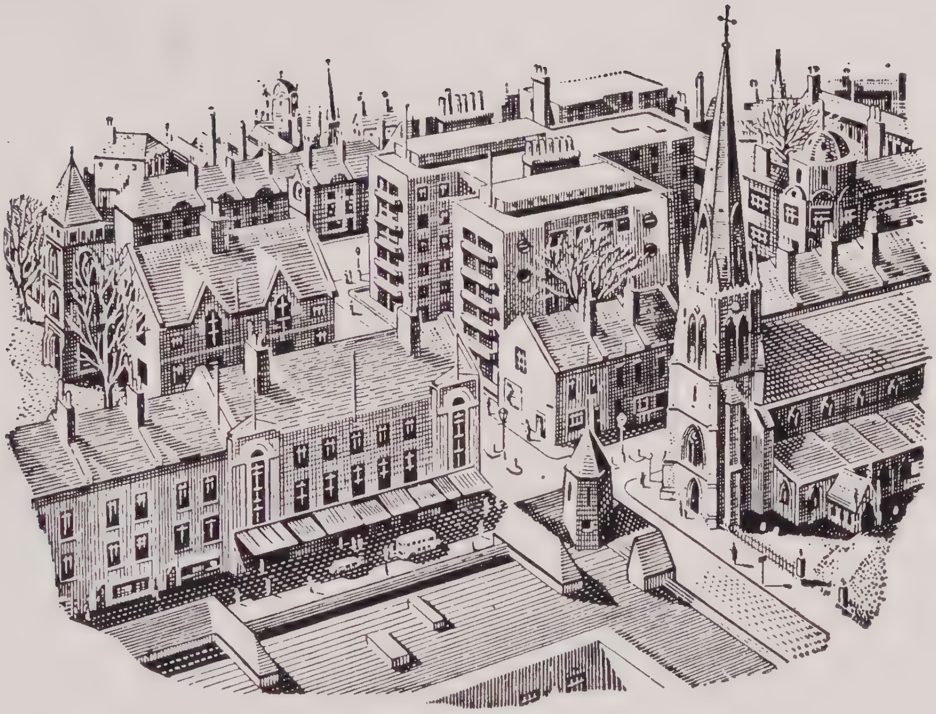

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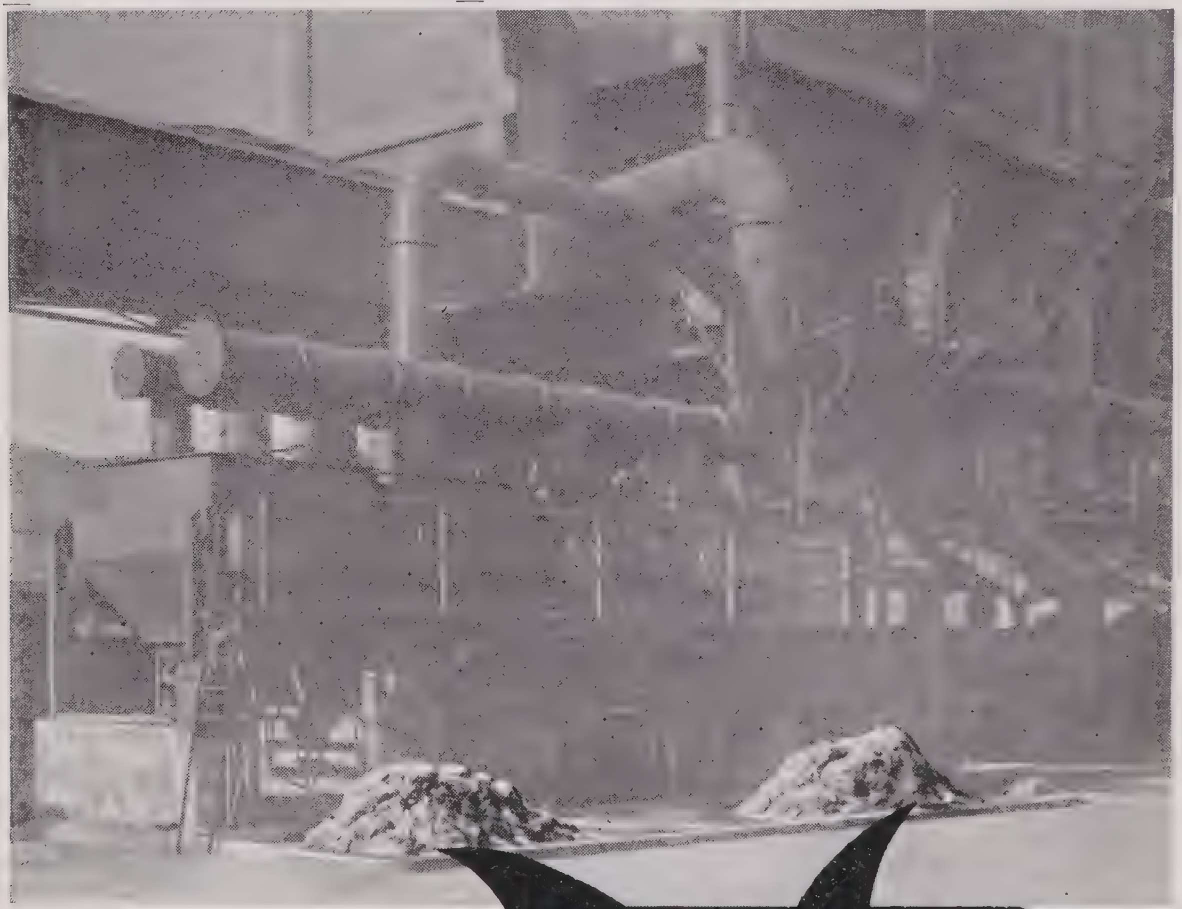

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SMOKELESS AIR

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SMOKELESS AIR is the official organ of the Society, but the views expressed in contributed articles are not necessarily endorsed by the Society. Abstraction and quotation of matter are permitted, except where stated, provided that due acknowledgments, including the name and address of the Society, are made.

Ships, towers, domes, theatres and temples lie
Open unto the fields, and to the sky;
All bright and glittering in the smokeless air.

SMOKELESS AIR

Royal Patronage

As has already been announced in our *Air Pollution News* and to the Press, the Society has been honoured by the gracious consent of H.R.H. the Duke of Edinburgh to extend his patronage to the Diamond Jubilee International Conference and Exhibition to be held in London next year. That His Royal Highness should have agreed to become Patron of this important celebration of the pioneer movement for clean air is a signal privilege, which will do much to promote the success of the event and to ensure that the high level of proceedings that is being sought will in fact be achieved.

Gathering Momentum

We had just written that we had not heard or read of any proceedings being taken under the dark smoke sections of the Clean Air Act, when news came of the two prosecutions in Birmingham that are reported on a later page. It is believed that these are the first cases to be taken to court under the Act. As far as the smoke control area side of the Act is concerned, as the returns recorded on another page show, there is a sudden marked increase in the number of proposals for which Ministerial approval is being sought. This is most encouraging, even though most of the areas are comparatively small. The proposed five square mile area for Manchester is, by contrast, a welcome sign of at least one authority starting to think big. The area is almost as large as all the others put together.

The era of smoke control areas is beginning with much less difficulty or protest than many people anticipated. Formal objections have been very few, and we hazard the opinion that as the first areas become established and become known, and the purpose of the reform is more widely understood by the public, these will proportionately be even fewer. Once or twice that hoary old fallacy about coke fumes has been raised, and much more explanation about fumes is necessary. Some interesting information will be found in the reports from the Society's Divisions that are to form the basis of the " Forum on Smoke Control Areas " at the Llandudno conference. Among other matters these will show how important it is that educational and propaganda work should be intensified and should form an integral part of all smoke control area proposals.

Litter

Although it may seem to be outside our own particular province, we feel that all members of the Society will join us in welcoming the new Litter Act. Air pollution and litter problems have much in common, and indeed the former is nothing but a kind of aerial litter. Both the Litter Act and the Clean Air Act seek to prevent unwanted material being disposed of in public places—on the ground or in the air—to the detriment of public health, cleanliness and amenity. In both cases the nuisance occurs because so many people are blind to ugliness and the wellbeing of the community, and because the discharge of filthy smoke or the scattering of unpleasant rubbish has become so habitual that by many it is not even noticed. Both reforms, despite the Acts that now help them, have the task of creating a new public opinion; but the anti-litter drive is fortunate in that it has not also got the technical problems that face the clean air movement.

Llandudno

At the time of writing the registration of delegates is keeping the office busy, and there are indications that the number attending will be greater than last year's record figure of 719. There are two interesting additions to the programme that was outlined in our last issue. On the Thursday afternoon, with the other technical and scientific papers, there will be a paper on the topical subject of " Hazards from Airborne Radioactive Material," by G. B. Courtier, of the Scientific Division, Public Health Department, London County Council. On the Thursday evening it is hoped to arrange a Cinema Show of new films relating to clean air.

The Thursday evening is the one free period during the conference, but the opportunity of seeing these films will, we are sure, be welcomed by delegates. They will include the practical film made by the Gas Council on conversions in smoke control areas, which is mentioned on a later page, a film from the Electrical Development Association, which we understand links clean air with the coming of nuclear power, one or two films from the noted library of Shell Mex and B.P., and, to finish, the clever, humorous (and very effective) new cartoon film, " All Lit Up," which is a remarkable example of the wonders that can be done with a subject so apparently prosaic as gas ignition.

By an unfortunate slip, the headquarters hotel was named in our last issue as " The Queen's," instead of the Grand. We do not think this has caused any serious confusion, but nevertheless apologize for the error. It is at the Grand Hotel, which leads directly on to the pier and adjoins the Pier Pavilion, that the informal " get together " will be held on the Thursday evening before the conference opens.

Conference Golf

Councillor Eric Gibbons of Brierley Hill, a Vice-President, has made the interesting suggestion that, as at some other conferences, a Golf Competition might be organized in conjunction with the Society's conference. If this should come about he very generously says that he would be glad to present a Challenge Cup. The intention, we should perhaps make quite clear, is that the competition would be held either before the conference opened, or after it had ended. We do not know how many delegates are golfers and would wish to participate, and it is now rather late to attempt to organize such an event at Llandudno. We should however be glad to hear from any members or delegates who are interested, both to show whether the proposal should be followed up for future conferences, and because it might still be possible to arrange at least an informal meet at Llandudno. Would such golfers please indicate whether they would prefer a game on the Tuesday afternoon (30th September) or the Friday afternoon (3rd October)?

Covenants

Many members have subscribed to the Society under a seven-year covenant, which has enabled the Society to augment the subscription by recovering the income tax that had previously been paid on it by the member. Such members have already been informed of the new ruling of the Inland Revenue authorities, which is affecting the Society and many other organizations. This is to the effect that, even though the organization is recognized as a charity for taxation purposes, and covenants can still be entered into, they can no longer be applied to *membership* subscriptions, if such subscriptions confer any rights of privileges. Members of the Society do enjoy such rights, which are specified in the Articles of Association (such as the right to receive this journal), so that covenants can now be made only in respect of donations. A number of covenantors have kindly agreed to allow their covenanted subscriptions to continue as donations, and to subscribe an additional and separate fifteen shillings or more a year, as the membership subscription. Others have said that their covenants should be discontinued.

This new situation is most unfortunate for many voluntary organizations, some of which will be affected much more seriously than the N.S.C.A., which derives a relatively small (although valuable) part of its income from covenanted subscriptions. It does however make it more difficult to appeal to prospective members to increase the value of their contributions by covenant. There is, we believe, a big scope for increasing substantially our individual membership, and for some time now we have been trying to fit such a drive into our over-crowded programme of activities. It will now be more difficult to get the benefits for this than might have been possible.

The new ruling is the result of the recent case of Commissioners of Inland Revenue *v.* National Book League, which was brought on the grounds that the League was offering privileges and facilities to its covenanting members that were in effect similar to those of a club. In many cases, however, the material privileges are little more than the receipt of a journal, the publication of which in the case of some of the learned societies is its principal function.

Willow Pattern

Many disapproving heads must have shaken over the story in the Press on 12th August under such headings as " Willow Pattern Pottery to Close—Clean Air Act Blamed." This, it may have seemed to some, is how a harsh and repressive Act stamps out our traditional industries! But the facts were not quite like that. The Coalport pottery, which produced the famous Blue Willow pattern in 1772, has not in fact been making this for the past thirty or forty years. The principal reason for its closing is, in the words of the chairman and managing director of the company, because " it was felt that the factory covered too large an area to produce economically at a time when it has become essential to have compact factories."

Secondly, he said, there was the effect of the Clean Air Act. " We did not feel we should be justified in spending the money necessary to change over from our present coal-fired ovens." On this a special correspondent of *The Times* reported from Stoke: " Opinion here is that the first of these reasons must be the overriding one." A " leading figure in the industry " told him: " A firm which could not afford the cost of converting its kiln operation could hardly expect to remain in business for long in any case."

Continuously operated gas, oil and electric ovens have been effecting a remarkable revolution in what was the Black Country. From since just before the last war the number of coal-fired intermittent ovens has fallen from 2,000 to 430, and the amount of raw coal used has gone down from one and a half million tons to 300,000 tons.

Off Beat

Though it was only a simple typing error, the order received by the Society for the supply of a Ringelmann chant appealed to our wayward imagination, suggesting a solemn choir of Smoke Inspectors, perhaps chanting that verse of Hardy's which begins " I have lived with Shades too long. . . ."

SMOKE CONTROL AREAS

Progress Report

The feature " News from the Local Authorities " that has been published in recent issues has been widely appreciated. Now, however, the considerable growth in the number of authorities concerned, at one stage or another, with smoke control areas, is making it difficult to keep the notes to a reasonable length and at the same time as complete as possible. We are therefore introducing the first of what it is hoped will be a continuing series of lists classified in the way shown. In this first report we give the position as from the beginning of the Act to 31st July. Subsequent lists will consist of later information to be added to the present lists, which will not be repeated in detail. We also hope to continue to publish news reports of matters of special interest relating to smoke control areas.

Notes. Some of the areas listed are new housing estates, or areas to be developed for housing. The total numbers of premises involved will therefore increase. An asterisk following the name of an authority indicates that there have been objections and that a formal inquiry has or will be held. A figure following the name of an authority, as " Liverpool 1," means " Liverpool No. 1 Area."

---

1. SMOKELESS ZONES IN OPERATION UNDER LOCAL ACTS

Birmingham (2 zones), Bolton, Bradford (centre and 19 housing estates), Coventry, City of London, Manchester (14 zones), Preston, Rochdale, Salford, Tottenham.

Total acreage	3,274
Total Premises.. ..	39,876

2. SMOKE CONTROL AREAS IN OPERATION (15th September, 1958)

Denton, Hayes and Harlington 1 and 3, High Wycombe 1 to 4, Leicester 1, Liverpool 1, Ossett, Prestwich.

Acreage	809
Premises	3,793

3. ORDERS CONFIRMED BUT NOT YET IN OPERATION

Audenshaw, Bermondsey, Birmingham 1 and 2, Bolton 1 and 2, Dudley, Fulham 1, Hayes and Harlington 2, 4 and 5, High Wycombe 5, Liverpool 2, Manchester, Oxford 1, St. Marylebone 1, Stoke Newington, West Bromwich 1, Westminster 1, Willenhall 1*, Woolwich 1, 3 and 4.

4. ORDERS SUBMITTED FOR CONFIRMATION BUT NOT YET CONFIRMED

Aireborough 1*, Chesterfield R.D., Edmonton, Exeter 1 and 2, Hampstead 1, Hayes and Harlington 7, Holborn, Kingston on Hull 1, 2 and 3, Lewisham, Liverpool 3, Newcastle-upon-Tyne, St. Pancras, Shoreditch, Tottenham, Wandsworth*, Willesden, Woolwich 2.

5. PROPOSALS NOTIFIED TO THE MINISTER

Aireborough, Ashton-under-Lyne, Basildon, Battersea, Bebington, Bedford, Bradford 1 and 2, Bristol, Camberwell, Chadderton, Chigwell, Crawley, Crompton, Croydon, Dagenham, Deptford, Dewsbury 1 and 2, Droylsden, Dudley 2, Ealing, Ellesmere Port, Enfield, Fulham 2, Greenwich, Hackney, Halifax, Hampstead 2, Harlow, Hayes and Harlington 6, 8 and 9, Hendon, Heston and Isleworth, High Wycombe 6, 7 and 8, Hornchurch, Hornsey, Huddersfield, Islington 1 and 2, Kensington, Lambeth, Leamington 1 and 2, Leeds 1 and 2, Leicester 2, Lewisham 2, Liverpool 4 and 5, Luton, Nottingham, Nuneaton 1 to 4, Oxford 2, Reading, Rochdale, Rotherham 1, 2 and 3, Royton, Saddleworth, Sale, St. Marylebone 2, Sedgley, Shardlow 1 and 2, Sheffield, Shipley, Smethwick, Southwark, Stockport, Stoke Newington 2, Sunderland, Tettenhall, Wanstead and Woodford, Warwick, Watford 1 and 2, Wednesfield, 1, 2 and 3, Wellington (Salop), West Bromwich 2, 3 and 4, Westminster 2, Willenhall 2 to 5, Wood Green, Worsbrough.

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Smokeless Zones (Local Acts)	43
Smoke Control Areas in Operation	11
Orders Confirmed but not yet in Operation	27
Orders Submitted but not yet Confirmed..	20
Proposals Notified	97
Grand Total ..	198

CLEAN AIR ACT NEWS

First C.A.A. Prosecutions

What are believed to be the first proceedings under the dark smoke provisions of the Clean Air Act were dealt with at the Birmingham Magistrates' Court on 8th July, 1958. Both cases were proved and fines imposed.

Clifford Coverings Ltd. were fined £5. It was stated that the smoke from their premises on 19th June was caused by the burning of unsuitable material in an incinerator.

The second firm was Bellis and Morcom Ltd., of Ladywood, Birmingham. In defence it was said that the emission of smoke was not denied, but it had been caused by essential maintenance work which had been going on in one of two boilers in the boiler house. It was submitted that under the regulations no offence had been committed. A fine of £10 was imposed.

Largest Smoke Control Area

The Manchester Corporation health committee has announced plans for what will be the largest smoke control area yet proposed. Situated in Wythenshawe, it will cover over five square miles and will involve 18,000 premises. The total estimated cost is about £350,000. The proposed area is almost as large as the combined acreage of all the smoke control areas so far confirmed throughout the country.

Industrialists and Clean Air

The provisions of the Clean Air Act were explained to a group of some 70 industrialists from the borough of Halesowen at a special meeting in the Council Chamber on 1st July. Mr. A. Archer, the Council's Chief Public Health Inspector, who has long been an enthusiast for clean air, was the exponent of the provisions of the Act and there were experts in the proper and efficient use of fuels at the meeting to give technical advice. Among those present were Mr. C. A. J. Plummer, (area engineer, National Industrial Fuel Efficiency Service). Mr. E. N. Wakelin (Chief Public Health Inspector, Birmingham), Mr. C. A. Stansbury (Chief Public Health Inspector, Walsall), Mr. J. Beighton (Alkali Inspector), Mr. F. M. Shaw and Mr. W. H. White (British Cast Iron Research Association), Mr. A. Basterfield, O.B.E. (Town Clerk).

£1,000 Air Survey

Bedfordshire County Council is to spend £1,000 on surveys into atmospheric pollution alleged to be caused by fumes from brickworks in the county.

Miners' Coal

The annual general meeting of the West Riding Clean Air Advisory Council at Leeds on 24th July agreed unanimously to urge the Ministry of Power to secure negotiations between the National Coal Board and the National Union of Mineworkers to try to settle the problem of miners' concessionary coal in relation to smoke control areas.

Measuring Pollution in Scotland

The principal towns in Scotland have been urged by the Department of Health to set up smoke measurement stations in the interests of the Clean Air Act.

Largest West Midlands Area

In our last issue we credited Dudley with the largest smoke control area project in the West Midlands. It has been pointed out that the largest so far appears to one of the three provisionally approved for Willenhall, which covers 390 acres and will have an ultimate population of 10,000.

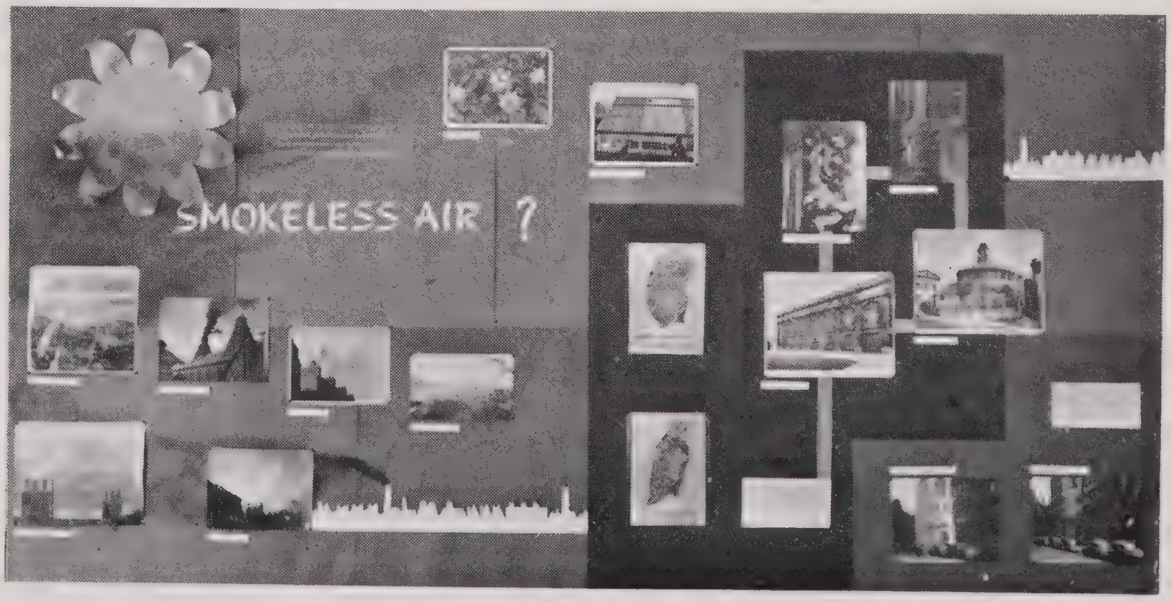
Hayes and Harlington

Hayes and Harlington have now had confirmed, approved in principle, or submitted for confirmation, nine separate smoke control areas. They account for 55 per cent. of the area of the district and 11 per cent. of the dwellings.

Doncaster Clean Air Committee

Doncaster's Medical Officer of Health, Dr. H. L. Settle, is to suggest to the Town Council that a committee representative of all fuel burning interests—from the industrialist to the housewife—should be set up. First, however, Dr. Settle is to write to a number of organizations asking if they would be interested in the formation of such a committee, which he visualizes would also include representatives of fuel distributors, members of the Town Council, and trade unions if they so wished.

His conception of the function of the committee would be to: observe the application of the Clean Air Act; act as an advisory body; become a medium for the dissemination of information. He believes that such a committee would also help to bring the importance of the smoke pollution to the various sections of the community.



An effectively presented Wall Newspaper display of photographs from the Society's Photo-Library at the Horsley Towers Training Establishment of the Electricity Council

CONTROL OF DARK SMOKE FROM SHIPS

The Permitted Periods Regulations

The Dark Smoke (Permitted Periods) (Vessels) Regulations, 1958 (Statutory Instrument No. 878, 1958. H.M.S.O., 3d.) were published on 30th May last, allowing a brief reference only to be made in the Summer issue of this journal. Details were included in the Society's bulletin, *Air Pollution News*, but for reference and for the benefit of the majority of readers, they are repeated again, below. A discussion in the House of Commons on these Regulations is also recorded in this issue.

The regulations permit dark smoke to be emitted for periods that vary according to the class of case, as shown in the following schedule:

Class of Case	**Aggregate permitted period of dark smoke emission**
1. From forced draught oil-fired boiler furnace or oil engine.	10 minutes in any 2 hours
2. From natural draught oil-fired boiler furnace (except in cases falling in class 4 below).	10 minutes in any 1 hour
3. From coal-fired boiler furnace:	
(*a*) when the vessel is not under way (except in cases falling within class 4 below).	10 minutes in any 1 hour
(*b*) when the vessel is under way.	20 minutes in any 1 hour
4. From natural draught oil-fired boiler furnace or coal-fired boiler furnace in the following cases:—	
(*a*) a vessel with funnels shortened for the purpose of navigating the Manchester Ship Canal;	20 minutes in any 1 hour
(*b*) a tug not under way, but preparing to get under way or supplying power to other vessels or to shore installations;	
(*c*) a vessel not under way but using main power for the purpose of dredging, lifting, pumping or performing some other special operation for which the vessel is designed.	
5. From any other source	5 minutes in any 1 hour

In addition, *continuous* dark smoke caused otherwise than by the soot-blowing of a water-tube boiler, shall not exceed:

1. In the case of classes 1 and 2 above ..	4 minutes.
2. In the case of natural draught oil-fired furnaces in class 4	10 minutes.

Cable Scrap

One of the many problems involved in the recovery of scrap is that of cable stripping, and when cable is burned it can give rise to unpleasant smoke nuisance. With the new Act in force mechanical stripping has assumed greater importance and the firm of F. C. Larkinson Ltd., have developed a cable stripper that has practically eliminated burning. It is described in the 30th May issue of *Metal Industry*.

Smokeless Collieries

Three of Fife's biggest collieries, Valleyfield, Bowhill and Minto, became all-electric during the miners' holiday fortnight as part of a plan to prevent smoke which might contravene the Clean Air Act.

CLEAN AIR POSTERS

Society and " News Chronicle " to Sponsor Competition

As many of our members know, the Society is urgently in need of new posters for the clean air campaign—especially to meet the needs of local authorities and others in their exhibitions and other publicity. A competition, open to all, is therefore being arranged under the joint auspices of the Society and the *News Chronicle*, each of which is contributing to the prize money of £200. Details are not yet complete, but it is likely that the panel of judges will include two or three well-known art or design experts, with the Editor of the *News Chronicle* and the President of the Society.

A novel and interesting feature will be that the winning and most commended designs will be the subject of a second competition in the *News Chronicle*, when readers will be asked to choose from the entries which make the most appeal to *them*. This will greatly add to the publicity value of the competition proper and will give the Society helpful information about what the public really think about clean air propaganda.

The Society held a successful poster competition in 1937, and has made continuous use of the winning design, which was printed and has recently had to be re-printed. More choice of subjects is however desired, and above all bright new ideas and different kinds of treatment are hoped for.

Full information, conditions and entry forms will be available shortly, and will be circularized to Schools of Art, and others likely to be interested. Copies will of course be sent to any readers on request. Local authority readers are invited to assist by bringing the competition to the notice of art schools and clubs, and individual artists, in their area.

Although it is much too early for a decision to be made, it is hoped that it may be possible to exhibit a selection of the entries, perhaps first in London and then in other centres.

Some New Publications

It hardly seems necessary to mention the **Memorandum on the Industrial Provisions of the Clean Air Act,** of the Ministry of Housing and Local Government. (H.M.S.O., 1s.). By now this should have been secured by all local authorities and by others concerned either with the administration of the Act or in having to comply with its industrial sections. It is a companion booklet to those on smoke control areas and the miscellaneous provisions, and describes each of the industrial sections, with many practical suggestions on administration.

Other booklets and pamphlets on various aspects of the Act continue to be issued, and mention must be made of **Clean Air for You,** published by the Solid Smokeless Fuels Federation, which is a popular short version of the practical booklet prepared primarily for the guidance of local authorities. It fully describes the smoke control area aspects of the Act, the authorized fuels and what they are and will do, and explains about the modification and replacement of appliances.

The Women's Advisory Council on Solid Fuel has carried out a survey among industrial householders and through branch meetings of various women's organizations, on the domestic use of coke. **Bulletin No. 14** of the Council, **Survey Into the Domestic Uses of Coke,** contains the findings of this inquiry. The samples of opinion taken may not be a true cross-section of public opinion (51 per cent. of the individuals questioned, but only 26 per cent. of the members of organizations, use coke), but the answers given are revealing and helpful to those concerned with the problem of popularizing coke. Among other points, the answers show (i) there is frequent difficulty in obtaining satisfactory results with coke-burning appliances, (ii) the belief that coke produces fumes is still widespread, (iii) storage is a problem for many, (iv) in some areas sizing, quality and distribution methods are not always satisfactory, and (v) the fuel value of coke is not fully understood and appreciated, so that it is thought that it should be cheaper than coal and that it is a product " with all the goodness taken out." These criticisms are not unfamiliar to many readers of this journal, and once again emphasize the urgent need for more, and still more, education and propaganda.

NIFES (National Industrial Fuel Efficiency Service) have issued, as No. 7 of their *Notes*, a four-page pamphlet for industrialists on the Clean Air Act. It gives essential information required by individuals in compact form and explains how NIFES can assist.

Two Text-Books for Industry

Turning to full-size books, we have received from Heywood and Company Ltd., London, copies of two of their technical text books, both of which are excellently printed and produced.

The first, **Dispersion of Materials,** by Rolt Hammond (pp. 230, 40s. net) is a volume in a series on " Physical Processes in the Chemical Industry," which is intended to provide technological text books to executives entering industry with the H.N.C. or a degree, and required to handle development schemes, pilot plant or main production lines. This book deals with the crushing and grinding of materials, fluidization, flotation, liquid dispersion and the dispersion of gases and pollution of the atmosphere. This last chapter is less concerned with the prevention of smoke than with the treatment of flue gases or effluents for the removal of dust and fumes, especially in the chemical industry. It should be valuable not only to those working on such jobs in industry, but to those who are concerned with them in administering the Clean Air Act. Students seeking to enter the Alkali Inspectorate would find it a helpful text-book to have.

One of the most general causes of inefficient, smoke-producing boiler operation is the lack of the instruments that are needed to ensure control. The other book from Heywood's, **Boiler Plant Instrumentation,** by W. R. L. Kent, D. C. Gunn and G. F. J. Murray (pp. 159, 21s.), is a clearly-written and extremely useful book on the subject that can be used as a text-book by the student or a reference book by the technologist or engineer faced with instrumentation problems. It is complete in that it first describes the kinds of plant used for steam-raising, the basic measurements that are needed, and then the instruments and the way in which they are used for obtaining these measurements. The automatic control of boilers is also discussed, and there is a short final chapter on incentives and methods of control—*i.e.*, how can we make sure that the information that the instruments supply is going to be used as it should be used?

This is again a book which although primarily intended for technical people in industry, or going into industry, should be on the bookshelf of every Smoke Inspector who wishes to be able to give good advice and wants to understand quite clearly why he is giving it.

New Steel Process

Experiments and pilot plant trials lasting ten years by Appleby-Frodingham Steel Co., Ltd.—a branch of United Steel Companies, Ltd., and a member of the N.S.C.A.—have led to development of a new de-sulphurizing and sulphuric acid plant far ahead of any similar process. It is expected to reduce the difficulties of low-sulphur steel manufacture and will also reduce atmospheric pollution. The first full scale plant is now being installed and is due for completion next year.

The Society's Finances

A.G.M. TO CONSIDER SUBSCRIPTION RATES

MEMBERS and Representatives will have received the formal notice of the Annual General Meeting to be held at the conclusion of the conference at Llandudno on 3rd October, and will have noted a resolution to amend the Bye-Laws so that the minimum subscription rates will be increased.

The resolution will be moved on behalf of the Executive Council, which have given careful thought to the question of the Society's financial situation in relation to the work it is attempting—and is expected—to do. Subscription rates have not been increased since 1952 despite the considerable rise in the kinds of costs the Society's work entails—printing, postages, display material, press cutting services, as well as rent and rates and the general level of salaries. At the same time the commitments and responsibilities of the Society have expanded, so that in effect we are receiving less real money with which to do more.

That the position has not been made impossible is simply because there has been a moderate but helpful increase in membership, and that we have been fortunate enough to receive from a small number of members subscriptions that are considerably more than the " standard "—that is, the minimum as laid down in the bye-laws. We are grateful for this generous help and hope that it will be continued and even augmented, and that we shall gain more Sustaining Members (that is, those who subscribe £100 or more a year).

Most members, however, do not see their way to contribute in this way, but it is believed that a fractional increase in the minimum rates will be understood and accepted. The minimum has always been kept as low as possible to encourage membership on the broadest possible base, and the changes proposed do not alter this principle.

The only members whose subscriptions will not be affected by the resolution are the individuals, most of whom already contribute above the modest fifteen shillings specified in the bye-laws. Corporate and local authority *Associates* are also not affected, as they are defined as those who contribute any sum that is less than the appropriate membership subscription.

If the resolution is approved, the increased minimum subscriptions should materially assist the present situation, even though it can only go part of the way towards enabling the Society to work with the effectiveness that is so urgently desirable. This aim is discussed more fully in the new appeal leaflet *For Clean Air* mentioned in our last issue (a copy of which will be sent to any reader on request). In brief, to work effectively and efficiently on the present basis and programme, requires the annual income to be raised to at least £20,000. At present it is only about half that figure. Beyond that, to develop the national campaign of education and information that is needed if the Clean Air Act is to succeed, in the field in which the Society is the most (or only) appropriate body, calls for an income of £50,000 or more.

The booklet itemizes the purposes for which the first £10,000 a year is needed. These are headed as follows:

Publicity Material—£3,000
Educational and Information Material—£2,500
Information, Library and Advisory Services—£1,500
Press publicity—£1,000
Investigations—£1,000
Conferences and Meetings—£1,000.

Working from the inside, dealing every day with one aspect or another of the Society's present work and future projects, we know that this appeal for funds is amply justified. But we also know that it is not so easy to convince others, even our own members. Is it not possible that someone will cynically suggest that here is another example of Parkinson's Law in operation? (That the work of an organization expands according to the time available for its completion.) At least, is it not the simplest thing in the world to set out schemes for spending money?

This has to be accepted. Let us therefore look at the Society's case from another viewpoint—by looking back instead of forward. The pages of this journal during the past year, and the annual report when it is published, will show to some extent what the Society has done. What is not shown, however, is what the Society could and ought to have done, but was *prevented* from doing simply by lack of funds.

Approved for action by the various Committees and the Council, or urged by members and planned to be put forward for action when it is known that they can be carried out, is a growing list of projects and developments, all of which would help to promote the campaign for clean air.

Thus lack of funds—which means in effect lack of staff, time, and facilities—has prevented the preparation and publication of new leaflets, for popular distribution, which have been asked for by a number of local authority members, as well as the preparation of a series of special booklets for architects, builders, teachers and others.

It has prevented the development and improvement of our display material, which is constantly on loan, to such an extent that frequently we have been unable to assist members at all. It has likewise not been possible to proceed with the production of film strips, slide sets and other " visual " aids to propaganda.

It has prevented the better ordering of our library, abstracting and information services; prevented the Society from participating in some useful exhibitions and in others allowed only second-rate displays.

It has frustrated much of the more detailed, day-to-day publicity that in the past has helped the Society steadily and firmly to extend its influence and membership—such as through personal correspondence and contacts, press letters, and small, special campaigns of opportunity. It has slowed down the essential work of seeking new members and contributions, and recently even delayed the dispatching of orders and sending out of accounts for the big influx of sales of publications and Ringelmann charts. The general routine office work of the Society, which *has* to be done (and often to a fixed time-table) has increased, willy-nilly, very sharply indeed as a result of the Clean Air Act and all the activity it has engendered. We would very much like to be able to prove this by statistical evidence—but, as should be obvious from what has been said, there is just no opportunity for compiling this!

It is reported that in two or three years time the Hornsey locomotive depot will have disappeared, and with it the smoke nuisance which it creates. In place of the depot there will be only a small fueling station for the diesels which are replacing the steam locomotives. At present the Hornsey depot deals with about 80 steam locomotives. All these are being replaced by diesels, which will be serviced and maintained at a big new depot to be erected at the Clarence marshalling yards at Isledon Road, Finsbury Park, and on which work has already started.

The Coal Utilization Council recently presented a memorandum to the Minister of Power, inviting him to represent to the Minister of Housing and Local Government that it would be desirable for a general exemption to be given under Section 2(4) of the Clean Air Act, to furnaces fired by mechanical stokers in smoke control areas.

The Damage to Books and Documents caused by an Impure Atmosphere

By W. H. Langwell, F.R.I.C.

MOST of our modern records consist mainly of paper; consequently the librarian and archivist have a special interest in avoiding the many agencies which damage or destroy paper. Some books and documents are irreplaceable, and may have to be preserved for periods of time reckoned in centuries. Among the many troubles which beset the archivist and librarian, perhaps the most insidious are those due to the attack of paper by atmospheric sulphur dioxide. Sulphur damage is usually slow to develop and become apparent, and is at any stage quite irreversible.

It is only during the last few years that careful quantitative investigations have brought to light the kind and extent of this damage, and pointed the way to preventive measures. While some forms of pollution—as for example smoke and grit—may be expected to diminish fairly rapidly in the future, due to legislative action, it seems unlikely that the amount of sulphur dioxide will diminish markedly so long as coal and oil remain our chief sources of power. Consequently it is advisable that everyone who has the care of paper documents should understand not only who sulphur dioxide can injure paper, but also how to prevent this injury.

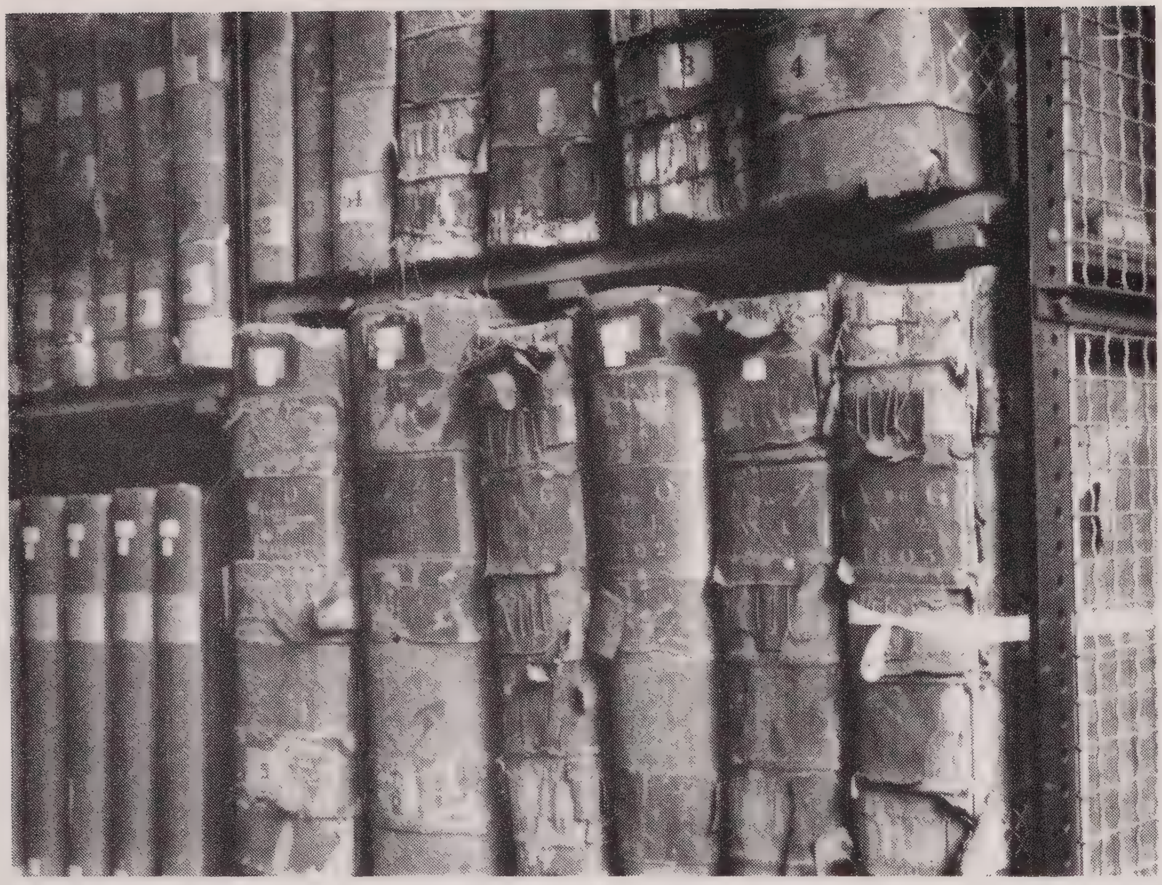
Stated in its simplest terms, the sulphur dioxide in the air coming into contact with paper containing, as it usually does, small traces of certain metallic impurities—such as for example iron, copper and manganese—is changed from the harmless sulphur dioxide to the highly dangerous sulphuric acid. Since this is relatively non-volatile, it can build up in the paper until sufficient is present to ruin the strongest paper. Samples of paper have been analysed which contained as much as 1 per cent of sulphuric acid picked up from the air, and this amount of such a strong acid renders the paper as brittle as glass by destroying the fibre.

Extreme examples of this kind of damage are to be found in books kept on open shelves in libraries during the period 1880-1920, when coal gas was commonly used for lighting.

It is difficult in a photograph to show clearly the damage done to paper by sulphuric acid, but the illustration which shows typical sulphur damage to bound books is quite spectacular. Since paper is damaged in much the same way as leather and binding materials, it may be inferred that the paper in the books illustrated is also badly damaged.

Modern research is bringing to light the many contributing factors involved, together with the atmospheric sulphur dioxide, in causing damage to paper, and with the available information many methods of minimizing or preventing attack are being worked out. While it is not possible in a short article to describe in detail either the causes or the cures, many private owners of valuable books or documents may like to have some indication of the simpler and more general remedies which can be applied where only a few books or documents are involved.

Perhaps the simplest and most obvious precaution is to keep the books in a closed bookcase; books on open shelves are very liable to attack, unless the shelves are in a closed and unventilated room with tight-fitting windows and doors kept closed. The illustration shows what can happen to books kept on open shelves in an urban atmosphere. Documents can be similarly protected by keeping them in



Damage due to sulphur dioxide. Books awaiting repair and re-binding. (*By courtesy of the Public Record Office*)

cardboard boxes, which need not be airtight but should have fairly well-fitting lids. Attractive looking plastic envelopes should be avoided unless they are made from one of the safer plastics—polyvinyl-chloride and similar chlorine-containing plastics may be dangerous because they may liberate hydrochloric acid under certain conditions, and this acid is even more dangerous than sulphuric acid.

The principle behind these simple precautions is the prevention of free circulation of polluted air over the books. Even a badly polluted urban atmosphere rarely contains more than one volume of sulphur dioxide in two million volumes of air; consequently very large amounts of air have to make contact with and diffuse into paper before enough sulphuric acid can accumulate to cause damage. With books on open shelves the damage is usually concentrated at the spine and round the margins of the pages, more particularly the top margin.

It has been noticed that sometimes books printed before about 1720 are immune to sulphur damage; this may be due to the fact that papers made before the invention of the beating engine escaped one source of metallic contamination, namely that due to the wear of the steel blades of the beater, the finely divided metal from which found its way into the paper. The beating engine is now universally used in modern paper manufacture, and unless special processes have been used —as for example in making certain photographic papers—modern paper will usually contain sufficient iron to make it more or less vulnerable to sulphur damage.

Atmospheric sulphur dioxide is no respecter of quality in paper, but a strong high-grade paper will naturally survive attack for longer than a weaker paper, because of its greater reserves of mechanical strength.

In conclusion, there seems to be no reason why modern paper should not last as long as the ancient Egyptian

(*concluded page 36*)

THE
LONDON FOG OF DECEMBER, 1957*

by

J. A. Scott,
O.B.E., M.D., F.R.C.P., D.P.H., Q.P.H.
Medical Officer of Health, London County Council.

IN an investigation** in London over the three winters 1954–55 to 1956–57 it was found that the critical level of atmospheric pollution, in relation to its effect on health, was reached when the daily concentrations of smoke and sulphur dioxide in the atmosphere were in the region of 200 milligrams of black suspended matter per 100 cubic metres of air and 40 parts of sulphur dioxide per 100 million parts of air.

The mean level of pollution covering the area of the Administrative County of London was arrived at by averaging the readings of seven volumetric recording stations, all at the same height above ground (first floor level) and so sited geographically to give a reasonably representative reading for the county as a whole.

During the three winters there was a fog in January, 1956, which attained this level and which it was estimated caused 480 " excess " deaths.†

The fog of December, 1957, also attained this level. Fig. 1 shows the daily mean concentrations on each of the foggy days 2nd-6th December, 1957, and six days on each side of them, with, for comparison, similar figures for the fog of 3rd-7th January, 1956—the days shaded include both those on which the mean concentrations exceeded the level chosen, and those days immediately surrounding them on which there was any mention of fog in the meteorological reports of Kew Observatory: the highest and lowest temperatures recorded at Kew over the same periods are also shown. The two smogs were somewhat different in that over the five days of both, smoke in December, 1957 was 84 per cent and sulphur dioxide was 120 per cent of the corresponding volumes in January, 1956.

Fig. 2 shows the seven-day moving average of deaths *occurring* in London, excluding the 90 deaths in the Lewisham rail disaster on 4th December, over the period 20th November to 18th December, i.e., the smog days and about two weeks either side of them, for all deaths and for deaths under 70 years and 70 years and over. Because of the use of seven-day moving averages the figure for any one day is influenced by the number of deaths on that day and three days either side of it, hence the thickened lines of the curves represent the effect of deaths during the foggy days. The estimation of the number of excess deaths is determined, somewhat arbitrarily, by linking the daily trend of deaths before and after the subsidence of the peak figure of 189 on 6th and 7th December—shown by the broken line in the diagram. On this basis the number of excess deaths represented by the bulge in the mortality curve works out at some 300 deaths. The rail disaster deaths, though an indirect consequence of fog, are excluded because the purpose of this study is to arrive at an estimation of the number of deaths directly attributable to smog through its direct effect upon human beings.

Before accepting this estimate it is

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*Reprinted by kind permission from *The Medical Officer*.

**See Appendix B to Annual Report, MOH, LCC, 1956.

†Logan, W. P. D. (*Brit. Med. J.*, 1956, i, 722), estimated the excess deaths at 440.

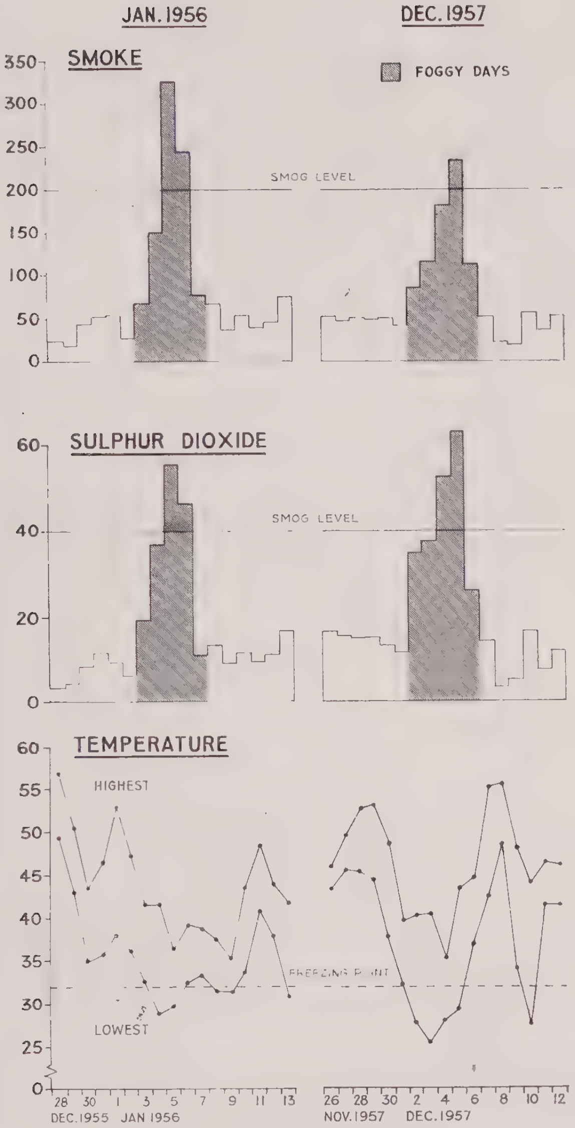

Fig. 1.—*Daily concentrations of Smoke* (*mgm. black suspended matter per* 100 *c.metres air*) *and Sulphur Dioxide* (*parts per* 100 *million parts air*) (*average reading of* 7 *stations*) *and Highest and Lowest Daily Temperatures* (*Deg. F.—Kew*) *in Smogs of January* 1956 *and December* 1957

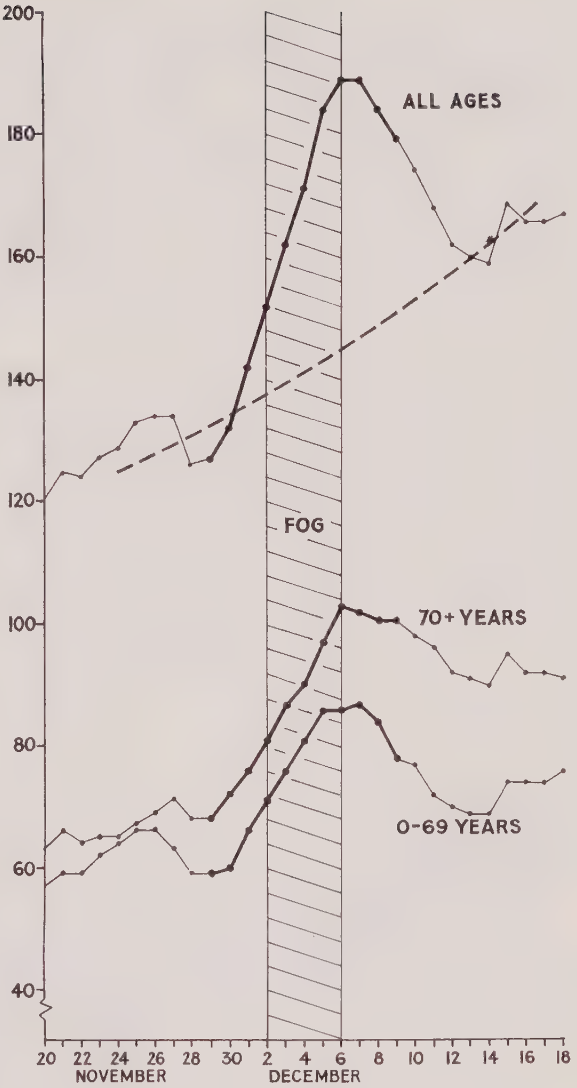

Fig. 2.—*Deaths*, all ages,* 0–69 *years and* 70 *years and over,* 20*th November to* 18*th December* 1957—*seven day moving averages*

necessary to study the general background of the weather and mortality at this time. It was cold over the period of the smog, as it invariably is during fog, with night temperatures below freezing point. There was no cold spell immediately following this smog with which to contrast the effect of cold and smog, as was done with the smog of January, 1956, but the even colder weather in the week of the 19th-25th January, 1958, produced no such similar disturbance in the level of mortality. A further complication was the presence of the influenza epidemic in the autumn of 1957, but the peak mortality from this cause and associated respiratory diseases occurred in late October, after which the number of deaths fell to a little above the normal seasonal level rising again in mid-November and continuing to rise after the smog episode to the highest figure of the winter in the week after Christmas. Viewed in perspective, the bulge in the curve due to smog occurred on a rising gradient of mortality, in a period when deaths were at a level higher than usual *following* an excess of deaths due to the influenza episode. Of the causes of death during the smog and the week following, the greatest proportionate rise was in diseases of the respiratory system, especially in bronchitis; there was also the customary rise in the number of " mentions" of respiratory disease on death certificates. After consideration of all these aspects there is no reason to doubt the validity of the estimate of 300 excess deaths directly attributable to the smog of December, 1957, or 400 if the deaths resulting from the Lewisham rail disaster be included.

**Excluding deaths in the Lewisham rail disaster.*

An interesting feature of this smog, in contrast to the smog of January, 1956, was that it affected both those under 70 and those over 70 years of age. In January, 1956, it was the old people who died; in this smog, when there was less smoke and more sulphur dioxide, the under seventies also died, but on the basis of a detailed inquiry of about one-third of London the excess deaths in this group were mainly among persons aged between 50 and 70 years. It would be foolish to make deductions from the experience of this one episode about the relative importance of smoke and sulphur dioxide on mortality and this research must be carried on over a series of such smogs before any firm conclusions can be drawn.

I would like to add here my thanks to the medical officers of health of the metropolitan boroughs who are co-operating in this research by supplying the mortality data on which these findings are based, and to Mr. C. W. Shaddick, statistician to the health department of the London County Council.

From Our Photo-Library, No. 32 *K. Parker*

LIMEWORKS IN ACTION

The Clean Air Act in Scotland

A Progress Report read to the Scottish Division at its Annual Conference in Glasgow, May, 1958, by

Ian M. Robertson
Department of Health for Scotland

PERHAPS I might begin by reminding you that the Clean Air Act, 1956, whose application to Scotland we are discussing this morning, became law on the 5th July, 1956. It was provided in the Act, however, that it should come into operation on an appointed day and that the Minister of Housing and local Government and the Secretary of State might appoint different days for the coming into operation of the different parts of the Act. The Act had basically to tackle four main problems. First of all emissions of grit and dust, which come mainly from industry. Secondly, smoke from the domestic fire, which seldom produces dark smoke and need not produce smoke at all. Thirdly, emissions of dark smoke from the ordinary industrial chimney which, it is generally accepted, are wasteful, and avoidable, except in special circumstances, e.g., when lighting up or if the fuel is unsuitable, or if there is a defect in the furnace, or during operations such as fire raking or soot blowing. Fourthly, the particular case of certain industries which in our present state of knowledge may not be able to help emitting dark smoke.

After the Act was passed, the first question to be decided in Scotland, as in England, was whether the Act should be brought into operation all at once or by easy stages and, if the latter, which parts should be operated first. I think it was made quite clear during the passage of the Bill that the Government intended to bring the whole Act into operation as quickly as they could, but they had to be reasonable about it and to recognize that, while some parts of the Act could be brought into operation straight away, others needed a little time and preparation.

At the end of December, 1956, then, an Appointed Day Order for Scotland was made which provided that certain sections of the Act—and some of them very important ones—should come into operation as from the 31st December, 1956. Those sections included the control of new furnaces (that is, section 3) and the control of the height of new chimneys (Section 10). Both these deal with proposals for new equipment and it was obviously sensible that they should be brought into effect at once. Then there were sections dealing with the establishment of smoke control areas and the adaptation of fireplaces in such areas (Sections 11 to 14); the position under the Act of premises controlled under the Alkali Act (Section 17); the control of colliery spoilbanks (Section 18); the establishment of the Clean Air Council for Scotland (Section 23); the encouragement of research and publicity (Section 25) and one or two other provisions.

All these, as you will know, are described in two memoranda issued by the Department of Health for Scotland last year—one on smoke control areas and the other on the other provisions of the Act which are already in operation.

I am sure that you as a Society feel that of the provisions so far brought into effect those relating to smoke control areas are the most important. And I think you are quite right. When I am asked about progress in setting up smoke control areas in Scotland, I think I must start by admitting quite frankly that it has been much slower than in England and Wales. I do not think we expected progress to be very rapid. Indeed in paragraph 3 of our memorandum on the subject we said:

> "The establishment of smoke control areas will necessarily be gradual; it will need to be undertaken in stages, over a period of years in the larger towns. Progress will be governed by the supply of smokeless fuels, the rate at which appliances can be converted or replaced and the speed at which local authorities are able to formulate and carry through their smoke control plans. Above all, progress—and indeed the whole success of the operation—will depend upon public support: upon people's understanding of the problems involved, and their readiness to co-operate in smoke control measures";

and in comparing progress with England and Wales we must remember that at the time the Clean Air Act was passed there were already some flourishing smokeless zones set up under private Acts in operation in England and Wales. In Scotland local authorities had been much less active in this matter and there was in fact only one smokeless zone—a comparatively small one in the Sighthill area of Edinburgh—although some local authorities were already securing smokelessness in their housing estates by means of tenancy agreements. Thus England had a start on us. They were in many cases exploiting success whereas we have had to begin almost from the beginning.

This does not mean, however, that nothing is being done. The first local authority to get off the mark were Dumbarton Town Council, who made an order relating to 625 acres and over 1,000 premises. There were objections to that order and the Secretary of State therefore appointed a Commissioner to hold a public local inquiry in Dumbarton on 15th April. The Secretary of State has just received the Commissioner's report and, as the matter is now, as it were, *sub judice*, you will not expect me to comment on it today.

Edinburgh have recently made and advertised an order extending their existing smokeless zone at Sighthill to cover a further area of 138 acres and just over 1,000 premises. Preliminary proposals were received in the Department of Health some time ago from Kirkcaldy Town Council, and only last week from Glasgow. We also know that Edinburgh are considering the possibility of setting up a smoke control area somewhere in the centre of the city and that various other local authorities such as Hamilton, Kilmarnock, Motherwell and Wishaw, Paisley and Perth have been giving consideration to this matter.

Glasgow Proposals

I am sure that the representatives of the other local authorities I have named will forgive me when I say that I regard the Glasgow proposals as particularly important. They have planned to start with an area of 201 acres right in the centre of the city. It contains industrial, commercial and domestic premises and, assuming that their order is made, and the smoke control area set up, I do not think it is any secret that they have in mind to strike out boldly from the ground they have gained and cut across the city a great strip in which the emission of smoke will be controlled.

We mentioned in our departmental memorandum that there were two ways in which a local authority might decide to tackle the question of setting up smoke control areas. They might begin by easy stages on the outskirts where the air is comparatively clean (although I am sure no one in this Society will underestimate the amount of smoke that comes from the ordinary domestic chimney) and once people had discovered that a smoke control area was not such a terrible thing after all and indeed was beneficial, they might then work in towards the centre. Alternatively, they might decide to start boldly in the centre and work out from there. That is what Glasgow have decided to do. It was a courageous step, because the difficulties will, I am sure, be formidable, but certain cities in England have already shown that it can be done. I am told, for example, that the clearness of the air in the zone in the centre of Manchester is very striking and there could be no better publicity for the clean air movement than the successful establishment of a smoke control area in the middle of Glasgow where its beneficial effects could be seen by all. That is why I said that I regarded the preliminary proposals which we have received from Glasgow as particularly important, because I am sure that, if Glasgow show that it can be done, many of the other authorities who up to now have been tending to hang back will be encouraged to go ahead with their own proposals.

There are some associated problems in the setting up of smoke control areas on which I am sure you will expect me to say a word. First, supplies and quality of solid smokeless fuels. Proposals for new smoke control areas are all referred, at an early stage, to an advisory committee under the chairmanship of the Senior Scottish Officer of the Ministry of Power and on which the fuel producers and distributors are represented, but, generally speaking, we are told that there should be no difficulty about providing sufficient solid smokeless fuel for all the smoke control areas of which we have warning at present. Quantity is not, of course, the only thing. The coke available must be of satisfactory quality and people must be willing to burn it. There are undoubted difficulties here. Coke does not seem to have the faculty of inspiring love and undoubtedly many people in Scotland remember experiences with low quality cokes in the past and do not like it as a fuel. I think I can only say that the Scottish Gas Board, who are the principal coke producers, do believe that their modern coke if properly used burns easily and well and gives a good heat, and certainly they are constantly doing what they can to improve its qualities. I am sure that they are very ready to demonstrate their coke to, or discuss its qualities with, officers of any authority or organization which is interested.

Publicity

The question of publicity is, I am sure, very important. No local authority wants to go forward with proposals which are opposed by large numbers of their citizens and I am sure that any local authority which wants to make much progress in establishing smoke control areas will be wise to make use of the powers as to publicity conferred on them by Section 25 of the Act. I am glad to say that I know that some of the authorities I have named have this very much in mind. The Coal Utilization Council, the Gas Board and the Electricity Authorities are all skilled in the arts of publicity and will be glad to help. The basic aim I am sure is to get people to understand *why* smoke control areas should be set up (that smoke means dirt and that dirt wastes money and materials), what those areas mean, and what assistance is available under the Act to get the necessary adaptations carried out.

Perhaps I might add at this point that the Clean Air Council for Scotland—to which I shall be referring again shortly—have asked the Secretary of State to urge on local authorities in industrial and densely populated areas that they should install more smoke gauges. The readings from the gauges would be of value to many local authorities in publicizing their smoke control proposals—not only as showing statistically the difference between " before " and " after," but as an indication of just how dirty the air is. Did you all realize, for example, that in the centre of this city in the winter something like 19 tons of soluble and insoluble matter are deposited per square mile per month? I hope that local authorities will seriously consider installing smoke gauges a year or so before the establishment of smoke control areas. The cost and the labour required are not great and the results will be most valuable.

Before I leave smoke control areas, there are one or two general points that I ought perhaps to make. Firstly, the decision to establish a smoke control area is the local authority's and the local authority's alone. There is no default power to the Secretary of State in the Act to step in if he thinks the local authority ought to have established a smoke control area and has failed to do so. That no doubt is because Parliament regarded the establishment of an area of this kind as preeminently a matter for local decision and local knowledge. Since the Government generally are anxious for progress towards cleaner air, the Secretary of State might well, at some date in the future, find it necessary to urge local authorities to make more use of their powers to set up smoke control areas, but he could never suggest that any particular area should be a smoke control area—especially since each order establishing such an area requires his confirmation and he thus has a semi-judicial function.

Another point which I would like to emphasize is the importance of timing in the operation of setting up a smoke control area. The Act provides that, after confirmation of the order by the Secretary of State, it will not come into operation for at least six months. The local authority can fix a date further ahead than six months and, even after fixing the date, can postpone it by resolution if they find that desirable.

The date of operation is very important because, when you look at Section 12 which deals with the adaptation of fireplaces in private dwellings, you will see that the provisions for Government and local authority assistance towards the cost of adaptation are closely tied up with that date. A house started after 5th July, 1956 ought to have been built with the Act in mind, but existing houses situated in a smoke-control area will have to be adapted, if their fireplaces are not capable of burning smokeless fuel.

The adaptations must be carried out with the approval of the local authority and to their satisfaction and—unless they are adaptations required by the local authority by notice in writing—the expenditure on them, if it is to qualify for grant, must be incurred *after* the confirmation of the order and *before* the date of its coming into operation. I think almost certainly the officers of the local authority will have visited each property in the area before the order is made and agreed what works will be required, but formal approval to the adaptations should not be given and expenditure on them should not be incurred until the order has been confirmed. I think the reason for that is obvious. There is many a slip between the cup and the lip and, if for some reason the order was not confirmed, the work would have been carried out with no possibility of Government or local authority assistance. The period then between the date of confirmation and the date of coming into operation is very important, since all the work of adaptation has to be approved and the expenditure incurred between those two dates. The local authority will have to estimate how much time will be needed to get all the work put in train, considering no doubt such questions as the availability of plumbers, builders, etc., in the area.

Since I am primarily making a progress report, I will not say anything today about the grants towards the cost of adaptation of fireplaces in smoke control areas nor about the type of adaptation which will qualify for grant. We have said a good deal on these points in the Department's memorandum on smoke control areas, but, if there are any questions on this subject, I will be glad to try to answer them.

The Clean Air Council for Scotland

I mentioned earlier that the Act required the Secretary of State to set up a Clean Air Council for Scotland. Most of you will know that the Council was set up towards the end of last year with Sir David Anderson, the Director of the Royal College of Science and Technology here in Glasgow as its Chairman. The members are representative of all the main interests concerned with smoke (or clean air)—the local authorities, industry, the fuel producers, the retailers, the appliance manufacturers. The Council has already met twice and is about to hold its third meeting. It is now getting to grips with some of the difficult problems in this field such as the ignition of solid smokeless fuel. Its purpose is to advise the Secretary of State on any problem he may put to it, but it also has a duty to bring to his notice any matters which it regards as important. I hope that any of you who have clean air problems, which seem to be of national rather than of purely local importance, will not hesitate to let either the Department of Health or the Council know.

So far I have been speaking about the part of the Act which is already in operation. Before I finish I ought to say a word about the remaining provisions of the Act. Some of you will be aware that in England and Wales those provisions are to come into effect on the 1st June this year and you will know that while the provisions still to come into effect include those dealing with such matters as the requirement that grit and dust from furnaces should be minimized and the application of the Act to railway engines and vessels, perhaps the most important provision is that which will affect industry by prohibiting the emission of dark smoke from chimneys. Before this provision could be brought into general effect it was necessary, in accordance with the advice of the Beaver Committee, to decide what additional industries with particularly intractable smoke problems ought to be scheduled under the Alkali Act. There was a prolonged public inquiry on this subject in England and Wales and it seemed wise to us to wait for the results of that inquiry before making our Scottish proposals. Last month, in Edinburgh, a Commissioner appointed by the Secretary of State held a public local inquiry into a draft order based on the English and Welsh experience. We are now awaiting the Commissioner's report and as soon as possible after it is received the Secretary of State will be laying an order before Parliament specifying the additional industries which should be scheduled under the Alkali Act.

While I cannot be definite about this, I would expect that the appointed day for bringing into operation in Scotland the remaining provisions of the Act would be some day this Autumn—that is only a few months behind the English date of 1st June.

While the basic provision of Section 1 of the Act is that dark smoke should not be emitted from the chimney of any building, I think it is generally recognized that very short bursts of smoke for such purposes as furnace raking and soot-blowing are unavoidable from most factories. It was for that reason that the Act enables the Minister in England and the Secretary of State in Scotland to make regulations exempting emissions of dark smoke for specified periods. Regulations for this purpose have already been laid for England and Wales by the Minister of Housing and Local Government and will come into operation on the 1st June. Similar regulations have been drafted for Scotland and we have more or less completed our consultations with the various interests concerned about these.

As regards dark smoke, then, the position in Scotland from the Autumn of this year will be that it will, generally speaking, be an offence for a factory to emit dark smoke subject only to certain limited exceptions.

There are many aspects of the Act that I have not referred to, but I hope I have said enough to show that things are moving in Scotland. As I said to some of you last year in Dundee, we do not want prosecutions, we want clean air. And the more publicity the subject of clean air receives, the more the climate of opinion will change so that to pollute the air will be regarded as a bad thing to do, as a thing to be done only exceptionally when it is unavoidable and not as a matter of industrial or domestic routine. I am sure many industrialists now realize this and I would like to say how enthusiastic and knowledgeable the industrialists on our Scottish Clean Air Council are. If the Act is to be a success, however, it will mean above all a great effort by the local authorities and it will impose a heavy burden of work on their medical officers and sanitary inspectors. I know that many local authority officers have been giving up their spare time to equip themselves for this new responsibility and I am sure that it will be time well spent.

Mr. H. Margerison

We regret to have to record the death, in May last, of Mr. Harry Margerison, Chief Public Health Inspector, Halifax. He was a member of the Executive of the Yorkshire Division of the Society and very actively interested in the cause of clean air.

Dr. T. D. A. Townend

Dr. D. T. A. Townend, C.B.E., Director-General of the British Coal Utilization Research Association, who read the first Des Voeux Memorial Lecture to the Society at Margate in 1950, is to be one of the first recipients of the Gold Medal of the Institut Francais des Combustibles et de l'Energie.

Hull Smoke Caused by Dock Cranes

Most of the post-war installations on the banks of the River Hull are powered by electricity or diesel engines, and in the opinion of Dr. A. Hutchinson, Hull's Medical Officer of Health, the older installations should be brought into line. Commenting in his annual report, he says: "The steam wagon has gone; the steam roller and the steam train are going; it is high time that the coal-fired steam crane followed them into the museum."

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What They Say

Local authorities in their dealing with Yorkshire industrialists over the Clean Air Act will be well advised to keep off the sob-stuff line. They haven't got their brassy name for nothing.—*M. B. Tetlow, Principal Regional Officer, Ministry of Housing and Local Government, to the West Riding Clean Air Advisory Council.*

* * *

In a sentence, Lord Acton did point out that all power stations corrupt ?—*Leslie Hale, M.P., in the Commons debate on the Scheduled Processes.*

* * *

Change from a negative to a positive principle is to be welcomed where the relations of industry and public amenities are concerned. Thus the change of name of the National Smoke Abatement Society to the National Society for Clean air, which took place on January 1st this year can be welcomed as a recognition of the reality of a campaign for an ideal rather than the modest hope of, at best, the mitigation of a permanent evil.—*Times Review of Industry, June*, 1958.

* * *

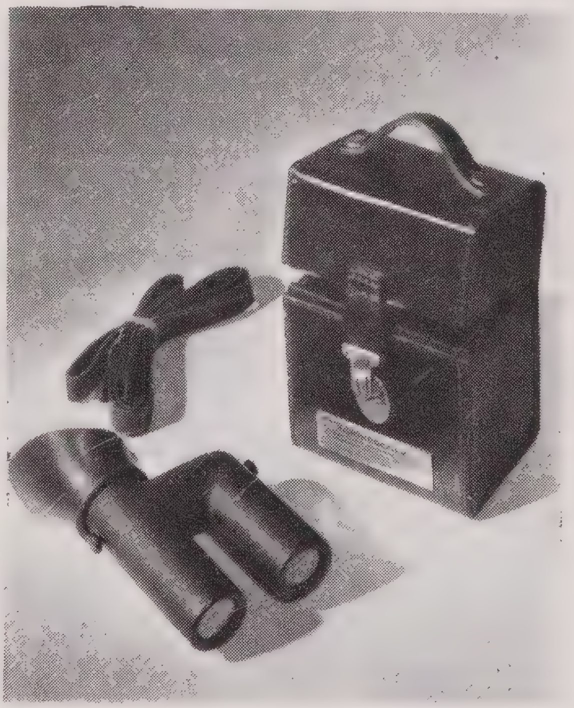
Among the casualties of the Clean Air Bill(*sic*) are the coke-ovens(*sic*) of Stoke-on-Trent, To the connoisseur of industrial landscapes these strangely shaped objects, belching smoke and flame were particularly precious.—*Peter Simple, Daily Telegraph, 13 August, 1958.*

* * *

Only recently we referred to the deplorable fact that the valuable work of the British Coal Utilization Research Association was being hampered by lack of funds. Now, with regret, we mention the case of the National Society for Clean Air, a body which has campaigned for nearly sixty years against the evils of air pollution and has been conducting its work almost on a shoestring. With the coming of the Clean Air Act, a new stage of the Society's work has been reached, one which calls for even greater activity than before, particularly in the educational field.—*Editorial in The Ironmonger.*

* * *

Miners' wives might solve the problem of their husbands becoming clean air-minded in spite of the fact that their menfolk receive concessionary coal. While the miner's wife does not perhaps realize the dangers to health from smoke pollution of the air, she is beginning to dislike the dirt created in her home by the burning of coal on open grates, and many wives have persuaded their husbands to convert their means of heating to electricity or gas.—*County Councillor C. Mann, of Ardwick-le-Street* (*Yorks.*)



The M.S.A. Smokescope

*This instrument, described previously in this journal, is now manufactured in this country by Mines Safety Appliances Co. Ltd., (Queenslie Industrial Estate, Glasgow, E.*3), *as illustrated, with case and carrying strap. Designed on the style of binoculars, but with only one viewing aperture, the Smokescope contains a standard film disc of smoke density which is viewed against the background adjacent to the chimney*

Environment and Diseases of the Chest

The Commonwealth Chest Conference

The Commonwealth Chest Conference, organized by the National Association for the Prevention of Tuberculosis, was held in London from July 1st to 4th. One of the many sessions was devoted to "Respiratory Disease—A Malady of Environment." The seven short papers presented dealt, in various ways, or touched upon, the factor of air pollution, and we record some of these as follows, either in full or in part.

The Aetiology of Disease

By Professor Charles Herbert Stuart-Harris, *Department of Medicine, University of Sheffield.* (*Extract*).

THE air which we breathe may contain abnormal concentrations of particles derived from organic or inorganic matter, or of gases not normally present, or of droplets or mists devoid of or containing chemical substances. We know that many of these substances, e.g., pollens, may be harmless to most but bothersome to a few who are possessed of a particular constitution. We cannot always draw the line between harmfulness because of the intrinsic character of the constituent and harmfulness to certain persons because of their peculiar susceptibility to attack perhaps because of some previous damage to the respiratory tract. We have to note the action of sudden increase in atmospheric constituents harmless in low concentration and which may cause acute effects analogous to poisoning or to an epidemic. We cannot be sure that continued low concentrations of a substance over a long period of years may cause effects or that these can clearly be distinguished from those normally regarded as the ageing process. Clearly atmospheric pollution is a maze of considerable complexity, which may be associated with acute or chronic effects in those with previously normal respiratory tracts or in those with some state of susceptibility of the latter. It includes specific industrial hazards such as silica dust as well as general pollution with smoke or sulphur dioxide. It also includes tobacco smoking.

The question concerning pollution which ought to be answered thus becomes:

> "*What is the significance of particulate matter whether organic or inorganic in nature, of gases and of mists for those exposed for varying periods of time in terms of acute and chronic disease of the respiratory tract?*"

Conclusion:

The problem which we are engaging in discussing is one of great importance, if only because history has shown that diseases which can be related to the environment are more readily amenable to prevention than are those which depend upon the constitution. Yet this brief survey may have shown that the problem is not one of deciding whether respiratory disease is related to the environment or not. The problem is that of deciding between the relative importance of various factors which operate as a complex combination and which defy the dissection into single elements which has so far been attempted. Once such a dissection has been accomplished it may then prove possible to relate single factors to particular syndromes, and to discern their importance either as primary causative factors or simply as aggravating circumstances.

Perhaps the final question ought to be:—

> "*How can we assess the relative importance of the various factors of the environment which now appear to be of broad significance in the causation of respiratory disease?*"

Cancer of the Lung

By Dr. W. C. Hueper, *Chief, Environmental Cancer Section, National Cancer Institute, Bethesda, Maryland, U.S.A.*

Among the considerable and rapidly growing epidemiological, clinical, pathological, and experimental evidence incriminating chemical and physical agents of our modern industrial environment in the causation of human cancers, none is as striking, convincing and serious as that related to cancers of the lung, and particularly to their remarkable increase in frequency during the past five decades. It can be stated with a great degree of certainty that the general pattern of the diverse information at present available on this subject practically excludes the possibility that any changes in the genetic composition of the population have played any important or significant part in bringing about these developments. The data on hand in fact strongly support the view that the majority of lung cancers are caused by exogenous agents, all or most of which enter the lung with the respiratory air, and many of which are industry-related. Whether or not the introduction of environmental carcinogens by other routes, such as the skin and alimentary tract, may also lead to the development of lung cancers is uncertain, although a few isolated case reports of human lung cancers, as well as a limited amount of experimental observations, favour the existence of such relations.

From a critical analysis of the large mass of diverse data on the subject of lung cancer the following facts stand out:

1. Lung cancers are not a disease entity but a group of diseases affecting the same organ but elicited by a relatively large group of rather highly different exogenous agents, attesting to the polyaetiology of lung cancers. Among these respiratory carcinogens are certain metals, such as chromium, nickel, arsenic and their compounds. Contact with these chemicals is not restricted to members of producing and consuming industries, but reaches also the general consumer in the form of antirusting agents in steam heating plants, insecticides, herbicides and other economical poisons used in the household.

Asbestosis cancers of the lung, on the other hand, have so far been traced in all cases to occupational exposures to asbestos dust. Likewise cancers of the lung attributable to crude isopropyl alcohol have so far occurred only among isopropanol manufacturers. The same restriction applies to lung cancers elicited by the inhalation of radioactive dusts and gases observed among miners and millers of radioactive ores. It is uncertain, however, whether this situation will continue to prevail under the recently developed pollution of the atmosphere with radioactive matter.

The most widespread and important contact with occupational and environmental respiratory carcinogens is doubtless related to distillation and combustion products of coal, petroleum, and other carbonaceous matter, especially tobacco smoke. Respiratory exposure to many of these agents involves not only large worker groups but also the general population through contact with air pollutants from domestic and industrial furnaces and exhausts from automobiles, buses and trucks, particularly in urban areas. These observations and considerations clearly demonstrate that cancers of the lung are attributable to various exogenous agents, to which individuals may become exposed for various reasons and from different sources, and which form a part of their total carcinogenic load.

2. The second important fact which emerges from an examination of the available total evidence of lung cancers is represented by the remarkable irregularity and variation of the epidemiological pattern of these tumours, especially in relation to their distribution in various regions, communities, population-, sex-, race- and age-groups as well as socio-economic and occupational classes. This phenomenon of irregularity extends also to the time of onset of the rise in lung cancer frequency, and its progression rates in the various groups and classes mentioned. Definite correlations in such matters exist in several occupational groups, in which the epidemiological pattern of lung cancers can be traced to the time of introduction of respiratory carcinogens into the human environment, the intensity and variations of exposure to them, and sex involved. It seems therefore justified to assume that similar variations in the exposure conditions to respiratory carcinogens underlie the marked and erratic fluctuations of lung cancer frequency of different demographic groups, localities and periods.

The theory, at present rather widely accepted, concerning the predominant role of cigarette smoking in the causation and frequency of lung cancers can account at best for only the smaller portions of lung cancers occurring. The environmental lung cancer panorama still contains many areas which are not accessible to our scientific vision and therefore defies at present any final and definite evaluation as to the significance of its various components.

At the present time any effective control of lung cancers as diseases of the modern environment must be based almost exclusively on primary preventive measures which must eliminate or reduce contact of the population with environmental respiratory carcinogens, whatever they may be. While such procedures may, and do require certain adjustments in our economical and personal life, they are without any doubt unavoidable prerequisites for our continued well-being within an environment which we have imposed upon ourselves by our own efforts and curiosity. We have to learn to live sensibly with the various new health hazards of our modern industrial environment, of which lung cancers are an important part.

The Relevance of Air Pollution

By Dr. Patrick Lawther, *M.R.C. Group for Research on Atmospheric Pollution; Director, Dunn Laboratories, St. Bartholomew's Hospital, London.*

The proper study of respiratory disease demands careful consideration of the nature of the ambient air; the relevance of atmospheric pollution is then obvious. Throughout the centuries many different pollutants have been held responsible for the causation or aggravation of disease; so much work has been described that at the first perusal of the vast literature some surprise might be felt that the connection between pollution of the common air and disease is not more firmly and specifically established. The great advances of the past may be studied with profit, but there is almost as much to be learned by considering modes of thought which may have retarded progress in research in this field.

The problem of the effects of air pollution on health has frequently been underestimated, merely because the answer looks so obviously simple. Eagerness to produce clear-cut explanations has too often led to reluctance to accept paradoxical findings which in themselves may reveal much of the truth of the matter. The need to examine thoroughly the complex chemical and physical structure of pollution has sometimes been forgotten and consequent failure to distinguish qualitative as well as quantitative variations in pollution commonly obscured the specific nature of its effects. All branches of biological research are fraught with the dangers of extrapolation of experimental results and this field is not exceptional in this respect.

"Smog disasters" where pollution reaches manifestly harmful concentrations have occurred often since the industrial revolution, and these incidents have been of great value in focusing public attention on the deplorable effects of dirty air. But they are freakish events and the common supposition that "smog" is synonymous with air pollution is wholly erroneous and continues to cause dangerous academic confusion. Scrutiny of past findings supplemented by the results of recent analytical and epidemiological research enables some classification to be made of distinct varieties of pollution together with their possible effects. Though as yet so little is known of the ultimate structure or mechanism of the effects of pollution the recognition of reasonable categories is of value:

Acute pollution occurs during temperature inversions over towns and is sometimes accompanied by persistent fog. The resulting miasma is called "smog," a term which has been taken to imply that it is a definite physicochemical entity.

Acute pollution may have a fatal effect on old people and respiratory cripples. Many people date the onset of their present chronic bronchitis from a definite episode of acute pollution and it is possible that it hastens the development of this disease in the hitherto normal person.

During the winter pollution often reaches high levels for short periods and escapes general notice. The effect of this *sub-acute* pollution cannot be measured adequately by reference to mortality statistics, but recent work has shown that the clinical condition of patients with chronic bronchitis is closely related to these exacerbations of pollution.

Chronic pollution, that to which town dwellers are exposed all winter, bears little resemblence to "smog." Belief in its harmful effects must still be largely intuitive but it is strongly suspect as an aetiological factor in chronic bronchitis and lung cancer. Both these diseases are closely related to the population density and other attributes of urban life are equally suspect; unfortunately these factors are closely associated with pollution and do not permit the easy assessment of their separate effects. This problem is the province of the expert epidemiologist.

There are *special* forms of air pollution which merit close study; men may be exposed in industry to high concentrations of contaminants which are found in acute urban pollution, and the health of such workers and the air they breathe must be examined carefully in case light may be shed on the community problem. Pollution of the air by vehicle exhausts constitutes another special problem.

This classification includes no mention of specific findings or current research but it provides a system in which many apparently conflicting past findings, analytical, experimental and clinical, fit with ease and it may save confusion in future consideration.

Throughout the long history of air pollution research there recurs the insistence that the proper solution to the problem is radical—the abolition of pollution; all who are to-day engaged in these investigations would agree and look forward with eagerness to the day, hastened by the recent implementation of the Clean Air Act, when the problem will vanish.

The Need for Research

By Dr. Edwin Francis George James, *Physician, Dungannon Chest Hospital, Co. Tyrone, Northern Ireland.* (*Extracts*):

Strictly speaking the environment is merely our surroundings, but in a medical sense it includes our standard of living and social habits. The pulmonary diseases which can be most closely associated with environment are tuberculosis, chronic bronchitis and cancer of the lung. There are also the industrial chest diseases; but these, although they exist, are not common in Northern Ireland; and in any case with proper attention to working conditions they ought not to occur.

There is no doubt that overcrowding and malnutrition aggravate the severity of tuberculosis and assist in its dissemination. Chronic bronchitis is extremely prevalent in Northern Ireland and in 1956 it killed nearly three times as many people as tuberculosis did. Our rather harsh, wet winters, cigarette smoking and atmospheric pollution must bear part of the blame for chronic bronchitis. Cancer of the lung is increasing in Northern Ireland as elsewhere and twice as many people died of this in 1956 as of tuberculosis. The association between cigarette smoking and cancer of the lung cannot be disputed by a reasonable person, and broadly speaking this is an environmental factor; but it is much more dangerous to be a smoker in an industrial city than in the country, and the probable explanation of the differential incidence of cancer of the lung is that atmospheric pollution contributes to the number of cases.

These, therefore, are three serious chest diseases in which an environmental association obviously exists, but its importance is difficult to assess, because our ability to protect ourselves from hostile surroundings, and in particular from disease, is an outstanding result of the application of scientific knowledge. It is possible therefore to blame the environment, when what is really at fault is that our research into disease has not yet gone far enough.

It seems highly significant that tuberculosis should have dropped so far behind chronic bronchitis and cancer of the lung as a cause of death, and it suggests that we are witnessing now the result of having found a specific remedy for tuberculosis and of having failed to find one for the other two diseases. If the common cold could be treated as effectively as tuberculosis, chronic bronchitis might soon cease to trouble us, because recurrent minor respiratory infections from childhood upwards eventually lead to the chronic bronchitic picture. Even if cigarettes could be abolished completely and the air became free from contaminating smoke, we should still be faced with the task of finding out the basic causes of malignant disease, and cancer of the lung is after all only one of the many cancers which can afflict us.

Let us by all means aim at the highest possible standard of living, at cleaner air and a rising generation of non-smokers; but we cannot hope that these efforts, however successful they may be, can overcome our difficulties: It is only continued scientific discovery which can free us from disease.

Analysis of the Air Pollution Factor

By Arnold Marsh, O.B.E., *Director, National Society for Clean Air.*

As the other contributors to this session will be discussing the medical aspects of the environment, it may be useful if the present paper is confined to reviewing the principal ways in which the pollution of the atmosphere impairs the natural environment and the extent to which this may occur. To begin with the amount of pollution that is discharged into the atmosphere of Great Britain should be noted.

It is estimated that the quantities of the principal pollutants, from the burning of coal and its derivatives, and from oil, per annum, is as follows:

Smoke	2,000,000	tons
Grit and dust ..	900,000	tons
Sulphur dioxide	5,700,000	tons

There are also large quantities of carbon monoxide, and, included in the smoke and in fumes such as those from road vehicles, are hydrocarbons and other compounds. There are also local forms of pollution, encountered only in the vicinity of certain industrial works, such as cement, limestone burning and certain kinds of chemical plant. Nearly one-half the smoke comes from domestic coal-burning fires. This is particularly obnoxious because of its high content of tarry matter and low level of discharge.

The ways in which this pollution may affect the health of those living in large towns and industrial areas (and probably, to a lesser degree, well beyond them) may be summarized as follows:

1. *Deprivation of Natural Light.* The overhanging pall of smoke reduces the intensity and duration of solar radiation, direct and diffused, to a marked extent. During the winter months one-half or more of the available light may be lost to the larger towns, compared with stations only a few miles away. In hazy or foggy weather the light received may be reduced to one-tenth of that outside the built-up area. The important ultra-violet radiation is reduced by a similar amount.

2. *The Respiration of Suspended Impurity.* The amount of impurity suspended in the atmosphere at breathing level varies widely according to locality and weather conditions. The more obvious heavier particles settle out by gravity and are observable as deposits, but the finer particulate matter and gases depend on atmospheric turbulence for their dispersal. During still, hazy weather the amount of suspended matter increases considerably, and during fog the concentration may rise to such a degree that smog, with its lethal potentialities, may be formed.

The degree of pollution experienced may be shown by comparing measurements of the suspended matter taken in the towns and in the cleanest areas to be found in this country. Such measurements are being carried out systematically and from the latest published report the figures given in Table I are extracted.

3. *The Deposition of Impurity.* The physical environment of those living in the towns and industrial areas is affected by the continuous deposition of what is best described by the one word, *grime*, but which is a mixture of soot, tar, oily particles, sulphur acids, mineral dust and grit, and many minor contaminants. The extent to which this occurs may again be shown by comparing high, average and low readings—corresponding to what are called the black areas, average areas, and clean areas—as in Table II.

The environment is thus degraded by atmospheric pollution in three distinct though associated ways. Each of these can be shown to affect the health of those living continuously in such environments, both by the promotion of specific maladies and by the general lowering of the level or standard of good health, which reduces resistance to other disease and, less obviously but probably significantly, impairs the physical and mental élan of the individual.

The deprivation of natural light is considered by some authorities to be even more serious than the consequences of the respiration of contaminated air, although the latter factor is of course of more direct concern to the present conference. Statistical evidence and discussion of

	Summer Months	*Winter Months*	*Year*
Highest recordings	31	81	56
Average recordings	12	32	22
Lowest recordings	1	3	3

(The figures are the monthly averages, as milligrams per 100 cubic metres of air.)

Table I

	Summer Months	*Winter Months*	*Year*
Highest recordings	3748	4439	4094
Average recordings	691	733	713
Lowest recordings	202	187	195

(The figures are the deposits in grams on 100 square metres per month.)

Table II

Presentation to Harold Moore

Mr. Harold Moore, of the Public Health Department, Manchester, who has been Hon. Secretary of the North West Division of the Society since its formation 12 years ago, has recently retired. He is seen receiving a cheque from the Divisional Council to mark their appreciation of all he has done for the Society in the North West and their good wishes for his future. Left to right: Mr. Moore, Mr. H. Clusky, Mr. N. H. Bridge and Mr. S. N. Duguid.

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the causation of bronchitis, cancer of the lung and other chest maladies, with reference to the influence of air pollution, will no doubt be advanced by other contributors.

The third factor indicated above, that of the deposition of grime, may not affect health directly, or if so only to a minor degree, and in particular it is not likely to affect directly the health of the respiratory system. But it *is* likely to have considerable indirect effects on the general level of health by lowering standards of cleanliness and amenity, and because of the psychologically harmful effect of living under conditions of unnatural gloom and drabness.

The new Clean Air Act gives hope for more rapid progress towards the reduction, and ultimate abolition, of atmospheric pollution, but it must be emphasized that much greater effort, sustained over a number of years, must be made if the advances that are technically possible are in fact achieved.

Tyre Dust Possible Cause of Cancer

Dr. Hans L. Falk, a biochemist at the University of Southern California School of Medicine, told an interviewer that almost a third of the material in tyres was a carbon black, " very rich in a cancer producing substance called benzpyrene."

He said Los Angeles traffic generates seven tons of tyre dust daily. He also said that tyre manufacturers could probably develop a satisfactory carbon black with a low benzpyrene content.

Commons Debate on the Scheduled Processes

Motion for Annulment of Alkali Works Order

THE Alkali Works Order, 1958, by which smoke control of the processes scheduled is made the responsibility of the Alkali Inspectorate, as provided for in the Clean Air Act, was debated in the House of Commons on 13th and 14th May, when a motion for the annulment of the Order was moved by Mr. Gerald Nabarro.

In the course of his speech Mr. Nabarro said:

" My hon. Friends on this side have been peregrinating around the country during the last few months endeavouring to convince everyone that block grants are a very good thing, because they restore authority to local people in local councils. That is a view which I very strongly support. This particular Statutory Instrument does exactly the opposite. It takes away from the local authorities powers in regard to enforcement of clean air policy which, in large measure, have reposed with them over a long period of years and transfers those powers to a Department of Central Government in Whitehall.

" Here I must quote a few figures in support of the assertions which I have ventured to make to the House in the last few moments. The effect of this Order will be to transfer control over the smoke, grit, and dust emissions from factory chimneys in respect of 110 million tons of coal burned annually in the works of the types specified, and 17½ million tons of coke burned in those works annually, together with 2½ million tons of fuel oil; a total of 130 million tons burned each year in those works of the types delineated in the two Schedules of this Order. As the total inland fuel consumption of the United Kingdom is of the order of 220 million tons each year, it follows that the control of emissions in respect of 130 million tons represents more than 60 per cent. of that total.

" Thus, in this matter of enforcement and implementation of clean air policy, the Alkali Inspectorate of the Ministry of Housing and Local Government is going to be the senior partner and the local authority the junior partner. Like myself, many hon. Members sat through thirteen long and tedious sessions of the Committee stage of the Clean Air Bill in 1956, and the theme then running through those discussions was that the local authorities should have the major part in the implementation of this policy. We never envisaged that when the Minister came to lay his Orders in respect of the Special processes he would be taking away from the local authorities 60 per cent. of the powers of enforcement in regard to the emission of smoke, grit, and dust from the works here specified."

Strength of the Inspectorate

Later, in the course of his speech, Mr. Nabarro continued:

" I want to refer to the strength of the Alkali Inspectorate of the Ministry of Housing and Local Government. The majority of hon. Friends who have approached me about this Order have made the point about the remote control of the Inspectorate in Whitehall which is no effective substitute for the local public health and smoke inspectors who have expert knowledge and long experience of local conditions. Attention has been drawn by my hon. Friends, and I wish to reinforce the point, that the Alkali Inspectorate is relatively a weak body. On the day the Clean Air Act received the Royal Assent, 17th July, 1956, there were ten inspectors and the cost was £17,480. On 1st June, 1958, which is the date on which the Order we are discussing will begin to operate, they will have risen to 19 at a cost of £33,730, and during next year my right hon. Friend informs me that, in order to deal with the added responsibilities arising from the Order before us this evening, there will be added a further nine officers at a cost of £14,000 per annum. Thus, we anticipate that, by mid-1959, the strength of the Inspectorate will be 28 highly trained and qualified men, costing £47,730 per annum. Even that strength is likely to be inadequate to deal with the onerous duties put upon them by the transfer referred to in this Order.

" Do hon. Members in all parts of the House realize that every power station in the country, every gas works in the country, every steel works in the country, every aluminium works in the country, to say nothing of ceramics and many other works and processes, are now to be thrust into the hands of the Alkali Inspectorate? I believe the strength envisaged for the Inspectorate is quite inadequate and that these central Government inspectors may well largely duplicate the work for which trained men are already available in the services of local authorities which cover industrial areas. The arrangements proposed in the Order may waste technical staff and will certainly suffer from the remoteness of Whitehall control.

" The inference that has been put to me by several local authorities and many of my hon. Friends, is that this is a measure of empire-building in Whitehall which ought to be resisted by all who have the interests of strong local government at heart. The Order will create divided control, doubt in the enforcement of clean-air policy, duplication of skilled manpower, and will undermine the success of the clean air policy, notably in black area conurbations, where many contiguous industrial local authorities' areas are involved.

" With the greatest regard and respect for the Minister, I say that he should no longer be the Minister responsible in view of the massive industrial interests involved. Responsibility should be transferred to the Minister of Power, who should be renamed the Minister for Clean Air and Power."

Sheffield

Mr. Nabarro was followed by Mr. R. E. Winterbottom (Sheffield, Brightside), who said he hoped the Order would not be withdrawn. He went on:

" We are faced with the present law and all its implications, but I want to put certain questions to the Minister. First, in Committee, after we had defeated the Minister, the then Minister of Housing and Local Government, in accepting Clause 17, said:

' The Standing Committee was concerned mainly to see that where a local authority had competent staff and facilities, and where in all other circumstances it was desirable, the authority should be empowered to carry out these functions by itself. The Committee was concerned that in those cases the Minister should be able to transfer the responsibilities to the local authority in question.'—(OFFICIAL REPORT, 10th April, 1956; Vol. 551, *c.* 36-7.)

" That was in the discussion on Clause 17. Is the Minister prepared to accept the spirit of the statement made by his predecessor and give to those local authorities with the competent staff to deal with the problem of the scheduled industries the power given to him under Clause 17(2) of the Act? Rather than defeat the Government to-night on something which cannot be altered because it is the law, assurances from the Minister that he will sympathetically consider investing authority under the Act in the local authorities in respect of these special industries would, in my opinion, meet the situation."

He went on to say that he had asked the Minister what was to be the position in Sheffield if the Order was passed.

" Until it is passed, no one can apply for permission. I have arranged with the authorities in the City of Sheffield that, if the Order is passed to-night, they will immediately apply for Ministerial permission, under Section 17(2) of the Act. But there is one doubt in my mind. I will at once pay a tribute to those in charge of the steel industry in Sheffield, that many of the steel companies in the City are far in advance of anything provided for in the Clean Air Act; many of the best employers are introducing innovations in their works which bring them completely outside the scope of the Act. But for all those who are doing this beneficent work, there are others who are not. The Act of Parliament was passed to prevent their being able to take advantage of that situation.

" It is in the interests of the good element in management that the Minister should give Ministerial consent to Sheffield controlling its own smoke, grit and dust, even under the new Measures to be brought in. It has been suggested to me—I do not know what force there is in it—that there is a desire on the part of the managements of some of the steel factories that there shall not be Ministerial consent to such a city as Sheffield controlling its own atmosphere.

"A very important question is raised here. Has there been any representation by any department of the metallurgical industry in the City of Sheffield imploring the Minister not to apply Subsection (2) of Section 17 of the Clean Air Act to the City of Sheffield? If such representations have been made, they have not been made in the interests of the city or of its steel industry, nor have they been made in the interests of developing this idea of clean air throughout the length and breadth of this country."

Ceramics

Dr. Barnett Stross (Stoke-on-Trent) spoke on the position of the pottery industry. In the course of his speech he said:

"As the right hon. Gentleman knows, we had a public inquiry into this matter, which was conducted by Sir Frederick Armer. He reported, as to-day we know to be true, that some pottery products in the heavy clay industry—such as tiles and certain types of brick—cannot as yet be produced in smokelessly-fired kilns, but perhaps the right hon. Gentleman will accept it from me that we feel that there is ample protection in the temporary exemptions contained in Section 2 of the Act, and there are five more years to go as from to-day.

" Speaking for my own local authority, I am empowered to say, quite categorically that, of course, the local authority will give every consideration to this fact. Apart from reasonable encouragement, pressure and incentive, the last thing we would want to do would be to do anything against the industry which would throw our own people out of work. We would never dream of doing that. On the other hand, if the Minister takes from us the right to act in the courts against offenders, the local authority becomes merely a smoke watcher—and hon. Members also become watchers of smoke, as it were, at second degree—for all that will be left to the local authority will be for it to come here and complain when there is undue delay in offering a remedy.

" I said last night that I had received a letter from the Parliamentary Secretary, who wrote to me, on behalf of his right hon. Friend, in response to the grievances put forward on this matter. I said that I thought that, perhaps—and I do not say this unkindly—some of the arguments advanced were a little off the beam. In the preamble to his letter the hon. Gentleman stated, quite rightly, how very interested the Ministry is in the new trends that are tending to give us clean air in Stoke-on-Trent.

" The hon. Gentleman went on to say:

' Where the conversion of intermittent coal fire kilns is feasible, it may involve major reconstructions which can only be accomplished gradually. In some cases development is hampered by lack of space; continuous kilns take up much more room that intermittent kilns, and some works will need re-siting.'

" I think that the answer we give is that for the majority of factories that would not be true. It may be true for some, and they would have to have special consideration from us, which certainly we would give them. Conversion is not a very expensive matter now. We know all the techniques, and they are available to the manufacturers, who very quickly regain any capital expenditure, for this is such a good economic proposition for them. Therefore, and in as much as this will not apply to the majority of cases, we feel that there is not a serious point in that argument."

"At the end of his letter, he said:

' If these works are scheduled you may be assured that the Alkali Inspectorate will require alterations to plant as soon as practicable if the products can be manufactured by smokeless methods. Only where the products themselves necessitate a coal fired intermittent kiln will the issue of coal be permitted for any lengthy period, and in those cases the Inspectorate will do all in their power to see that the appropriate research is carried out into the development of new techniques to achieve smokeless production.' "

The next speaker was Mr. Anthony Marlowe (Hove), who said " This is a Socialist measure. I know that even under Conservative Governments Socialist Measures slip through, merely because a Civil Servant has a Bill in a pigeon-hole and decides to put it out, and whatever Government is in power the Bill is passed through the House of Commons." He was followed by Mr. David Jones (The Hartlepools), Mr. John Grimston (St. Albans), Mr. Arthur Moyle (Oldbury and Halesowen) (who was solidly in favour of a central inspectorate), and Sir Henry d'Avigdor-Goldsmid (Walsall South).

The Minister's Reply

The Minister of Housing and Local Government (Mr. Henry Brooke) wound up the debate. In the course of his speech he said:

" My hon. Friend the Member for Kidderminster suggested that I should have made an Order, or several Orders, under Section 17(2) simultaneously with this Order. I have to point out that I have not the power to do that. The Act does not allow me to do so. If hon. Members will read the terms of the Act, they will see that the Minister can move under Section 17(2) only

' if, on the application of a local authority, he is satisfied . . .'

" It is true that this Order was made some weeks ago, but up to the present I have not received any such application from local authorities.

" I think that is quite natural, because the first step to take after this Order was made, and as it comes into operation, is to draw up a register of the works in each local authority area which will be affected by it. Only when it is firmly settled which works, as the result of this Order, will come under the Alkali Act can any question arise as to a local authority applying for action by the Minister under Section 17(2).

" I envisage that when the Order comes into operation, and these registers of works come to be compiled, large authorities which feel that they are sufficiently well equipped with a full-time trained smoke inspectorate will apply to me to see whether they can satisfy me under the terms of Section 17(2) that I should use my powers. From all my knowledge of the subject, I shall be surprised if the Stoke-on-Trent, Sheffield, and one or two other authorities, do not make such applications.

" May I say, in passing—because there were some allegations that control by the Alkali Inspectorate was always remote control—that in our strengthening of the Inspectorate we are proposing to have a district inspector and an assistant inspector based on Stoke-on-Trent, and likewise an inspector and assistant inspector based on Sheffield. I could give the House the other geographical areas which will be thus covered.

"Quite clearly, it would be wrong and improper for me to say what conclusions I would reach on any such applications until an application had been made and I could see the grounds on which it was supported. Any Minister charged with duties under an Act should come to conclusions on the merits of the case put before him, having considered it from all angles, and not on any prejudice he has formed for or against a particular local authority.

" That is the procedure I shall follow. It is important for the House to realize that the Act gives the Inspectorate the power of descheduling categories of works entirely, as it becomes established that research has shown how the problems of smoke emission can be overcome, and there is no longer any necessity for the particular interest of the Alkali Inspectorate.

" I should not be afraid, and I feel sure that every other Minister would feel the same, of using those powers to deschedule categories of works entirely when the time came. But the time has not come yet.

After dealing with some questions from Mr. Nabarro, the Minister went on:

" The Order before the House is, in fact, not made under the Clean Air Act. It is made under the Public Health (Smoke Abatement) Act, 1926. There have been four previous Orders of this kind. This one is distinctive because this is the first Order made since the extension to smoke, grit and dust was approved in the Clean Air Act, 1956. The reason for putting certain processes under the Alkali Acts is not to give these industries protection from any action taken by authorities, but because they have certain special technical difficulties, and it is considered essential that those special difficulties should be tackled by a single inspectorate with special technical qualifications reviewing each industry as a whole.

" In these cases they really are national problems as well as local problems, because the trouble is caused not by somebody in the boiler house neglecting his duties and allowing dark smoke to escape but by reason of the fact that scientific research has not yet solved the problem of operating a plant of the particular kind in question without risk of producing dark smoke.

" My predecessor ordered a public inquiry in 1956 to determine to what classes of works and of industry this action should be applied. About 4,500 different works would have been scheduled under this Order if all the applications made before that public inquiry had been granted. In fact, the inquiry, which was conducted by Sir Frederick Armer, resulted in a report which recommended that slightly less than half of all the works which industry had sought to get scheduled should be scheduled. I accepted the Armer Report virtually *in toto*.

" This Order will, therefore, apply to about 2,000 works out of a total of between 25,000 and 30,000 works throughout the country which produce smoke—so I can assure my hon. Friends that there is no question of local authorities being left with nothing to do. Indeed, it is not really true to say that this Order deprives local authorities of powers which they have hitherto had. In fact, though local authorities have had certain powers, they have constantly complained in the past that those powers are ineffective both against metallurgical works and other works."

Mr. Brooke concluded:

" I trust that the House will not accept any of the suggestions or insinuations that have been made—I am sure in the heat of the moment—that the Alkali Inspectorate is either an empire-building or a remote or ineffective body. I know it intimately myself. My own belief and conviction is that it is one of the most powerful instruments we could have in helping

Parliament to bring about what we all want—clean air for Britain.

" So far as I am concerned, my desire will be to use my powers in such a way that the Alkali Inspectorate has every opportunity to get on with the stimulation of scientific research where there are technical problems unsolved, that it should co-operate as closely as possible with the local authorities, and that wherever a local authority is well qualified to take over the work an order under Section 17(2) shall be made to enable it to do so."

Mr. Nabarro: In view of the ample and, I think, very generous explanations given by my right hon. Friend, and notably the assurance which he has given the House in connection with Section 17(2) of the Act, I beg to ask leave to withdraw the Motion.

Motion, by leave, withdrawn.

B.M.A. CLEAN AIR RESOLUTION

At the Annual Representative Meeting of the British Medical Association, Dr. I. R. D. Proctor of Chesterfield moved a motion in the name of Chesterfield Branch of the Association, as follows:

" That in view of the high mortality rate from bronchitis in North Derbyshire and certain parts of Yorkshire and Lancashire, and the known relationship between bronchitis and air pollution, this meeting considers that the provisions of the Clean Air Act should be rigidly enforced in these areas forthwith, and that local authorities be pressed to proceed with the establishment of smoke control areas."

The mortality from bronchitis, said Dr. Proctor, was notably higher in the industrial areas mentioned in the motion than in the rest of the country. Taking the overall average death rate as 100, some areas had figures of over 130. There was growing evidence that the incidence of bronchitis, and therefore mortality from it, was increased by air pollution, and especially by high sulphur dioxide levels. The Clean Air Act was a first step in the right direction, but suffered from weaknesses and omissions. The degree of reduction in air pollution depended on the enthusiasm of the local authorities concerned. Only a limited quantity of smokeless fuel, other than coke, was available for householders, and half the air pollution came from domestic chimneys, so that there was a case for increasing the production of smokeless fuels and giving priority in distribution to areas of high air pollution. Industrial concerns were given a seven-year period of grace in which to reduce their pollution by exhaust gases; a subsidy, reduced each year, would encourage early improvement. Many industrial plants came under the Alkali Act of 1906, as amended in 1926, and not under the Clean Air Act. That legislation was out of date, and the permitted level of noxious effluent should be lowered by making use of recent technical advances; the permitted level of 4 grains per cubic foot could be halved. No provision was made to curtail the building of industrial plant in areas already polluted. More attention should be paid to medical and meteorological advice in the siting of new plant.

After some discussion, and the defeat of an amendment to the motion, Dr. Tilley said that the Public Health Committee welcomed the motion and it was carried.

A report to the Medical Research Centre (the Institute Pasteur), suggests that Paris motorists should not idle their engines while stopped. All activities which produce smoke, including domestic fires, should be curbed as much as possible, the report states.

"SMOKELESS FUEL CONVERSIONS"

and "All Lit Up"

" Smokeless Fuel Conversions " is a ten minute practical film produced to show how the gas industry can assist when old-fashioned grates are converted to burn smokeless fuels in smoke control areas. It comes straight to the point and has been made primarily for showing to architects and builders and members of local authorities. It was produced for the Gas Council by Associated British Pathe Documentary Unit.

Also of distinct clean air interest is a most amusing cartoon film in colour, " All Lit Up," which explains the uses, and literally sings the praises, of the gas-poker—in a lively calypso. Made for the Gas Council by Halas and Batchelor, it is one of the cleverest little films we have seen and well deserves having been selected for showing at the Edinburgh Film Festival.

Both of these films will be in the programme of the cinema show being arranged at the Society's Llandudno conference. Copies (16 or 35 mm.) are available on loan from the Gas Council Film Library, 1 Grosvenor Place, London, S.W.1.

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STARTING A SMOKE CONTROL AREA

One Authority's Experience

By John R. Riding

From a comprehensive paper on Smoke Control Areas, read at a recent conference of the Urban District Councils' Association, by the Clerk to the Willenhall U.D.C., we have extracted passages that are of special interest because of the way in which they indicate the approach and experiences of one Urban District.

THE memorandum on Smoke Control Areas gives sound general advice on this point but a few observations based on experience might now be helpful.

It is a matter of opinion as to which part of a district a local authority chooses as its first Smoke Control Area.

In the first place the centre of a town which contains Civic and Commercial buildings would seem an obvious place to commence a Smoke Control Area, taking the view that charity begins at home. By doing this an opportunity could be taken to give a lead to the public. The West Bromwich Smoke Control Order which will be operative on 1st November next will cover 25 acres in the centre of the town and in addition to the Town Hall, Law Courts, Schools, Public Baths and a Hospital it will include about 191 dwellings, which were built about 1900. To deal with an area such as this, the volume of work is very heavy and the cost is also heavy as all the 191 dwellings require work of adaptation for the burning of smokeless fuels.

We in Willenhall looked at our town centre and came to the conclusion that it would be unwise, at the beginning to start there. We are one of those towns whose heritage from the past in the older part of the town is haphazard industrial development, much of it of the heavy type, intermixed with many substandard dwellings and other development. The main objections to starting there were:

(1) Factories in every possible area.

(2) The houses included in our slum clearance programme are nearly all in the centre of the town. We therefore decided to start with a new Council housing estate of 419 houses on the outskirts of the district. All the houses were of course equipped with approved grates capable of burning smokeless fuel in accordance with the requirements of the Minister when approving tenders, but nevertheless we had to provide gas lighters for lighting fires in half the houses and in some cases other work has been necessary. It is estimated that by using smokeless fuel on this estate alone the amount of deposits in the form of soot and other matter will be reduced by 30 tons per year.

It may be thought that we have started the easy way but we did this deliberately for the following two main reasons:

(1) We would gain experience of the procedure and such problems as would arise before starting on the difficult areas.

(2) That by tackling an area of this type we were more likely to get a Smoke Control Area in being quickly and successfully than in the older parts of the town and this would be of great propaganda value when dealing with other areas.

There is also the reason that tactically if one starts with Smoke Control Areas on the perimeter of a town like Willenhall and gradually works towards the centre, by the time you are dealing with the central or difficult areas the task will be much easier by reason of

(1) The more general acceptance of the necessity for clean air and thus less opposition.

(2) The problem of factory smoke should by then have been minimized by the exercise of other powers in the Act.

(3) The problem of slum houses will have been considerably lessened by clearance under the Council's slum clearance programme.

(4) The cost should be considerably reduced.

We are also in the course of making future Orders in respect of Council estates either in course of development or where building has not yet started and one private estate which has not yet been commenced. This is easier still. If houses owned by the Council (which of course are properly equipped to burn smokeless fuels) are subject to a Smoke Control Order before they are let, then the incoming tenant knows the fact before he takes the tenancy and must accept it. So far as Clerks are concerned I would commend this as a method by which you eliminate objections before you start and you are not bothered with a local inquiry almost idealistic.

So far as private estates are concerned the position is practically the same, if the local authority has made the model byelaw under Section 24 of the Act which provides that in new buildings only fire grates, etc., capable of burning smokeless fuels shall be provided.

With regard to new dwellings, i.e., those erected after 5th July, 1956, if the model byelaw is not in operation in the district, the cost of any adaptations necessary to comply with a smoke Control Order will be at the expense of the owner and will not attract the grant of 7/10ths of the cost which applies in other cases. It seems to me that it is fairer all round to make the byelaw to force the installation of smokeless grates when the houses are built so that when a smoke Control Order is made, the then owner is not put to the expense of adaptations.

In order to minimize possible objections to the order, propaganda leaflets and practical demonstrations seemed to us to be very necessary. During the course of the survey the fireplaces were inspected and questions asked as to whether the tenants were satisfied with them. Any complaints were noted for attention. In about a dozen cases, with the co-operation of the Gas Board, coke was taken to houses and on-the-spot demonstrations were given to tenants in their own grates. All this was very useful preparatory work.

Nevertheless, when the Order was made we had objections—over 200 tenants signed a petition of objection. I had never had so many objections to an Order before, and I had visions of an overflow Inquiry. Fortunately, only three turned up and our preparatory work bore fruit, for two tenants came along to support the Council.

I only want to say one thing about the Local Inquiry. We used it as a means of propaganda—diagrams and photographs were on display and, apart from the strictly formal evidence, we submitted evidence to show the adverse effect of smoke on the health of the people of own town. We used the Inquiry to try and persuade the *objectors* and the public generally that the Council was right. A local Inquiry gets good publicity. It is essential, particularly in the black areas, that all the local authorities should move along similar lines. This is not a case where a local authority should please itself about implementing the powers in the Act—in my view there is a moral responsibility. If one authority goes ahead with Smoke Control Areas and reduces the amount of air pollution from its district, it is the neighbouring area who benefits as well according to the prevailing wind, and conversely the Smoke Control Area will get some of the pollution from the other neighbour. We are all in this together and what we do or neglect to do in our towns has a bearing on the health of the neighbouring towns.

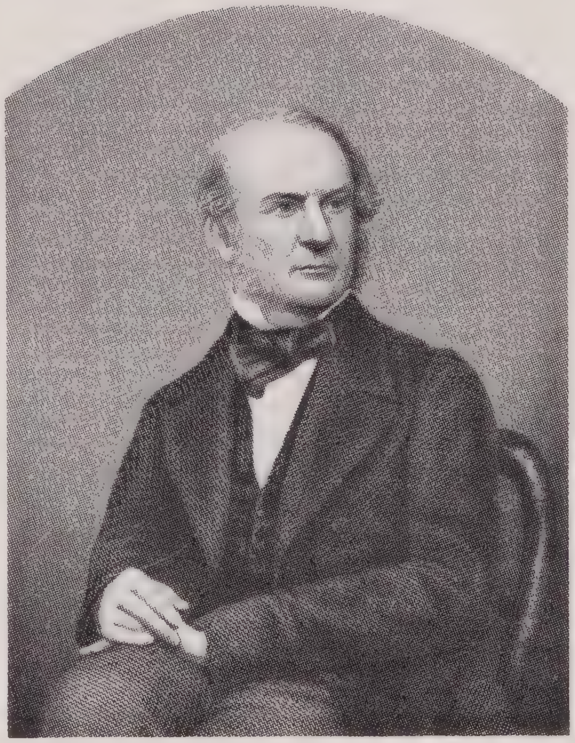
WHAT GLADSTONE SAID IN 1864

WE are indebted to Mr. H. Corscadden, Senior Public Health Inspector for Farnworth, Lancashire, for finding and sending to us an account of a speech by W. E. Gladstone in 1864, in which the great statesman was bold enough to deplore the smoke nuisance. The speech is recorded in a history of Farnworth and Kearsley, written in 1887, by B. T. Barton. We say "bold enough," for Mr. Gladstone was obviously being rather careful in referring to it—as when he hopes he will be excused if some of the audience think that "it is more of an individual crotchet than a public principle," and when he refers to "what I must even venture to call the smoke nuisance." This somewhat apologetic approach is an illuminating sidelight on the state of public opinion at the time.

The occasion was the ceremony opening a public park that had been donated by the Chairman of the Local Board, Mr. Alfred Barnes. Gladstone at the time was Chancellor of the Exchequer, and the relevant extract as recorded (with a little paragraphing, etc.) is as follows.

Mr. Gladstone rose to respond, and after speaking of the pleasure it gave him to meet the masses of the public, as it ought to do to all Members of Parliament, he proceeded:

"I now, Mr. Alfred Barnes, pass on to an agreeable portion of my duty—that of asking you to drink what I must call 'the toast of the day'—I come to name him who I must call the hero of the day. I ask you to drink the health of Mr. Barnes, the Member for Bolton, the donor of the Park. I won't say that enough has yet been said upon the subject of the Park; on the contrary, there are those near me—there is one in particular on my left (Sir J. P. Kay-Shuttleworth) whom I had hoped you would hear at length, who I still hope you may hear in conjunction with the present occasion. But of my words you have perhaps had enough in reference to the occasion of to-day. Well, ladies and gentlemen, if you have not had enough of them it is for me to say that conscience ought to restrain the inflictions that are demonstrated to you, even if your patience makes you forbear.



W. E. Gladstone in 1864, as Chancellor of the Exchequer
(From a print in possession of the National Liberal Club)

"The gift of Mr. Barnes will never be perfectly enjoyed until you have adopted more stringent regimen in respect to the discharge of smoke. Now, my belief is, ladies and gentlemen—you will excuse me if some of you think it is more of an individual crotchet than a public principle—but my belief is that it is a very important matter, and that—I do not speak merely to gentlemen who have an abundant supply of soap and water and towels, and who have plenty of time to use them—but for the masses of the labouring people it is exceedingly desirable that they should, if possible, live in a free atmosphere.

" Why, I will venture to say—I will make no reference to Lancashire, but I will take the case of London—I have not the smallest doubt but what between the application of soap and water to the person, their application to clothing, and their application to houses and furniture, if it were possible effectually to suppress what I must even venture to call ' the smoke nuisance,' it would be a saving of many millions a year to the population of the metropolis alone.

" But that is not all. Those who live in towns may, it is true, get into the country sometimes, but still their life is in the towns. Their visits to the country are for the most part few and occasional, if not far between. I do not believe that the Park of Mr. Barnes ever will wear that aspect of beauty which it ought to have or ever will open in full those opportunities of communion with the works of God in creation, which the Park is designed to give, unless we do make some progress in the career which has been opened to us, but which certainly has not yet been finally and fully travelled, and endeavour to make a further, aye, and a much more effectual and stringent improvement in regard to the consumption of unnecessary smoke.

" Well now, ladies and gentlemen, perhaps you will think that this topic of smoke may recall to your mind that balloon, for as smoke and gas are both of them rising fumes and vapours, there is a certain resemblance between them; in fact I plead guilty, in some degree, to the charge, which was so adriotly insinuated by my honourable friend in the chair. But having expressed my very sincere hope that something will be done upon that subject, I must again remind you that the doing of these things rests with you.

" It rests with you in your private sphere and capacity, as operating upon the Legislature, but I hope it is not visionary to entertain the belief that some of the younger people among us may see a great progress and improvement in this respect."

New Air Pollution Association for France

An Association for the Prevention of Atmospheric Pollution has recently been formed in France, with the cooperation of government, public health, fuel and power, and industrial interests. The provisional governing Board that has been elected includes the following: *President*—Professor Bugnard, Director, Institut National d'Hygiène; *Vice-Presidents:* Professor Raymond, President de la Commission Interministérielle de la Pollution Atmosphérique, and M. E. Arrighi de Casanova, Directeur du Commerce Intérieur; *Members:* Dr. Roussel, Institut National d'Hygiène, M. André Sallelles, Etablissements Classés, and M. Yvan Queret, Association Technique de l'Industrie du Gaz en France.

We are informed that the first aims of the Association will be carrying on the discussion already engaged in with the "Association de Maires de France" to define " smokeless pilot-towns " before the end of this year, to start publishing a journal " such as your *Smokeless Air*," and beginning to lead information campaigns. A series of conferences on Air Pollution is to be organized in 1959 in Paris at the Maison de la Chimie.

The French Academy of Agriculture is also reported to be setting up a committee to consider air pollution problems, together with those of river and sea pollution.

Smoke from Ships

New Regulations Discussed in the Commons

IN the House of Commons on 10th July a Prayer was moved for the annulment of the Dark Smoke (Permitted Periods) (Vessels) Regulations, 1958. (The Regulations are described on another page.) Mr. Arthur Blenkinsop, opening the debate, made it clear that the real purpose was not to destroy the Regulations, but to seek further information and give publicity to the matter. In the course of his speech he said:

"As I understand, the position under the Regulations is that a vessel may not emit black smoke for longer than three minutes continuously in a period of half an hour, which is a very considerable period, nor can dark smoke be emitted from oil-fired vessels for longer than a continuous emission of four minutes in half an hour. In some cases, longer periods are provided for.

One question that arises is that there appears to me to be no provision here, although it may have escaped my notice, with reference to the continuous emission in the third category in the Schedule. There is provision for the maximum emission in the aggregate for a period of an hour for coal-fired boiler furnaces in vessels, but, as far as I can see from the Regulations, there is no provision relating to continuous emissions in these categories, unlike the other categories specified in the Schedule to the Regulations. If I am mistaken about that, perhaps the Parliamentary Secretary can put me right.

Some problems arise under the Regulations. Some local authorities have been asking precisely who it is who will take action under the Regulations, and, of course, provisions are laid down in Section 20 of the Clean Air Act regarding the definition of which local authority should take action—the authority, apparently, which is nearer to the vessel committing the nuisance. There is also the question whether an authority like a port health authority will be able to take action. Indeed, that may be a much more suitable body to do so.

Then there is the further question as to what action is to be taken to let foreign shipping know that these Regulations are now in force, and what action may be taken by a local authority, by a port health authority, or by any other competent body, either to bring prosecutions or to warn vessels of this situation.

The cases where this is most likely to arise will occur in connection with some of our busier rivers and highly industrialized areas, and where there are a lot of tugs and possibly ferries in operation. That may be so in rivers like the Tyne and others. Many of these vessels are fairly large and mostly coal-fired. Under the provisions of the Regulations, it seems to be possible for such a vessel to do almost what it likes, because the limitation is a very slight one.

I appreciate the difficulties. Various bodies, including the National Union of Seamen, have issued some circulars putting forward their views and expressing their anxiety lest there should be any change made in the Regulations. I realize that there have been discussions with health inspectors, among others, about the actual wording of the Regulations, but I hope that the Ministry will watch its operation, and, if it proves necessary later, when more experience has been gained, will bring forward amending proposals.

I hope that they will encourage local authorities to take note of what occurs in those areas—I am not suggesting that this is necessarily widespread—where there may be a very real nuisance. I remember that not very long ago we had complaints from hon.

Members about offensive emissions of dark smoke from tugs and other vessels coming down the Thames. I hope that hon. Members will be reasonably careful in their checking of what happens after the passing of the Regulations.

One point almost of amusement is in the actual wording of the Regulations, which says:

'For the purposes of the said schedule a vessel is not under way when it is at anchor or made fast to the shore or bottom, and a vessel which is aground may be deemed to be under way.'

No doubt that is all necessary, but it is an example of what our legal draftsmen find necessary to say in Regulations of this kind. I invite the hon. Gentleman to give some explanation, if he can, of the one or two detailed points that I have raised and to give an assurance that the matter will be kept under review. I ask him specifically about the position of local authorities and port health authorities in enforcing the Regulations, whether he will be sure to take advice from competent bodies in the coming months and, if it is possible to strengthen these provisions, to take the earliest opportunity of so doing."

Mr. Blenkinsop was followed by Mr. R. E. Winterbottom (Sheffield, Brightside), who said he did not object to the Regulations, but that "the Government should give every encouragement to those responsible for the ships, tugs and small coastal vessels which enter our harbours and rivers to improve the installation of these boilers and furnaces that result in the constant emission, not only of dark smoke and of black smoke but, what is much worse—and not covered by the Act—grit and dust which fall upon our population. We know that the Government intend to pursue this Act to its logical conclusion, and the assurances for which we have asked will help to convince us of their purpose."

Colonel Sir Leonard Ropner (Barkston Ash) said, in the course of a speech: I want to make it clear at once that all sections of the shipping industry support, in general, the provisions of the Clean Air Act. Of course they do. I do not think, however, that any right hon. or hon. Member would dissent from the view that the Act was inspired, certainly by the advisability and, as some may think, the necessity of dealing with chimneys ashore. It was only incidentally, although correctly and unavoidably, that Regulations were introduced to deal with ships in our rivers, ports and harbours, which are often in the very heart of our great cities.

He concluded as follows: The House should know that the Seamen's Union and the officers' union and shipowners' organizations are unanimous in the view that the exemptions granted by these Regulations are the minimum possible if the Clean Air Act is to provide a sensible and workable code for shipping. I say again that I am glad that the Prayer was moved only for the purpose of obtaining information.

The Government Reply

The discussion was wound up by the Parliamentary Secretary to the Ministry of Housing and Local Government (Mr. J. R. Bevins). In view of the importance of this "official" statement, we record the speech verbatim. Mr. Bevins said:

Like my hon. and gallant Friend the Member for Barkston Ash (Sir L. Ropner), I was very glad to have the assurance of the hon. Member for Newcastle-upon-Tyne, East (Mr. Blenkinsop) that this discussion had been initiated for exploratory purposes and that he had no intention of dividing the House. If I may say so, I think that that is a very good thing because, if there were a Division and, by any chance, this Prayer were to succeed, the shipping industry would be in a very sad plight indeed.

I would like, first, to give the House some background to the Regulations and then to deal with some of the rather detailed questions which have been put by hon. Members. The House will know that Section 1 of the Clean Air Act, 1956, prohibits the emission of dark smoke from chimneys and that Section 20 of the Act applies this prohibition to vessels. Under the Act, my right hon. Friend has power to make regulations exempting certain periods of dark smoke emission from the general ban. In March this year, as hon. Members will recall, he exercised this power in the case of shore installations. For vessels, which have entirely different problems, and, generally speaking, more complicated problems, than land installations, my right hon. Friend has now made the Regulations which are tonight before the House. They permit vessels to emit dark smoke for certain periods without offending under Section 1 of the Act.

The Regulations, as the hon. Member for Newcastle-upon-Tyne, East said, specify the permitted periods, which differ according to the class of boiler or the engine in the ship. All these periods are subject to the overriding proviso that black smoke—that is, as dark as, or darker than, shade 4 on the Ringelmann chart—should not be emitted for longer than three minutes in the aggregate in any period of half an hour.

That at once raises the question why the Minister has made these Regulations less stringent for ships than the earlier Regulations which applied to installations on land. We should much have preferred, had it been practicable, to introduce stronger Regulations than we have done. Indeed, for the sake of clean air, which we all want, I agree entirely with my hon. Friend the Member for Wavertree (Mr. Tilney) that we should like to see smoke from ships stopped altogether, but that is easier said than done.

The making of the Regulations presented a good deal of difficulty, as my hon. and gallant Friend the Member for Barkston Ash well knows. We have power to cover a wide range of vessels from the aristocratic liners to the more plebeian trawlers, tugs and all the other small craft that inhabit our rivers. We have had to take into account the different types of boiler plant in use and the extent to which alterations or re-equipment to improve performance is feasible.

There are all sorts of other factors: for example, the state of the shipping industry itself, what we can reasonably expect of tired crews, and particularly tired stokers, coming into harbour perhaps at the end of a very tiring journey and the fact that we have to provide for ships standing alongside and ships which are under way in all sorts of weather, wind and tides. In saying this, I am in no sense apologizing for the Regulations, but I want to give the House some idea of the complexities surrounding the subject.

We have, as my hon. and gallant Friend the Member for Barkston Ash said, hammered out these standards after discussions with the Ministry of Transport and Civil Aviation, the shipping industry, the seamen's unions and with the dock and harbour authorities, and certain of the port health inspectors. I do not want, at this hour, to plunge into a sea of technical details, as one easily could on a subject of this sort, but I must say that the majority of ships now in commission have oil-fired boiler furnaces. For these, the Regulations lay down a general limit of 10 minutes of dark smoke in two hours or in one hour where there are natural draught boilers. There is also a limit of four minutes for continuous bursts of dark smoke. Longer periods are allowed for coal-fired ships when under way, but there is an over-riding limit of three minutes to black smoke in any period of 30 minutes.

These are clear and, I think, effective limits, and, taken as a whole, the Regulations certainly represent a much stricter control over smoke from ships than has been possible hitherto under the Public Health Acts. Until now it has been necessary to prove nuisance in the case of smoke from harbour craft, and nuisance by black smoke in the case of sea-going ships, and very rarely in practice did the black smoke emission cover shipping. In any case, sea-going ships were exempt from its application.

The hon. Member for Newcastle-upon-Tyne, East very rightly asked an important question about enforcement. Who, in the first place, will enforce these slightly complicated Regulations? The enforcement authorities are the usual local authorities, other than county councils, except in those areas where there is a port health authority. In those areas, such as the Thames, Merseyside, and Tyneside, the port health authority will be the responsible body.

We have brought all these Regulations to the notice of all these authorities in an explanatory memorandum which was issued by my right hon. Friend by circular of 29th May. Naturally, I have read it and it certainly expresses far more simply the import of the Regulations. I will see that hon. Members who have evinced an interest in the subject tonight will receive a copy of it.

How will these authorities discharge their obligations for enforcement? It would be quite idle for me to pretend that this will be an easy or simple task. After all, the factory which belches smoke is on the ground and is immobile. The vessel is usually mobile and is on water. I know that that is a statement of the obvious, but we ought to bear that in mind when we consider these Regulations. Ships under way are like moving targets.

Mr. Blenkinsop: Some of these ships might be aground.

Mr. Bevins: I am coming to the hon. Member's subtleties in a moment.

As I have just said, ships under way are like moving targets and it might not be easy, in certain circumstances, to keep a ship under proper observation. When there is no public health authority, the question is: which authority will be responsible for enforcement?

Section 20 of the Clean Air Act says: "... a vessel in any waters to ... which are not within the district of any local authority shall be deemed to be within the district of the local authority whose district includes that point on land which is nearest to the spot where the vessel is."

Complaints have been made about the draftsmen, but these words are a tribute to them. They are a far better definition of what we had in mind than any words that my right hon. Friend and I could devise.

If a ship is leaving port, the authority will have to observe the offence and transmit notice of the offence through the ship's agent. In the case of foreign-owned ships we have told the local authorities and port and harbour authorities to explain the position on first contravention and, if the authority later decides to take proceedings, we have asked it to notify the consular office of the country to which the vessel belongs. I think that perhaps for the moment that is as far as we can go, but my right hon. Friend is certainly open to any suggestions of an administrative kind which we could implement to make that a little more effective than it is.

Mr. Winterbottom: Those of us who have tried to apply in our minds the problem of clean air to ships also realize some of the difficulties, particularly with foreign ships, and we appreciate the difficulties which the Minister will have in consultation with the Customs officials. I think that it will be a long process of education.

Mr. Bevins: I agree with the hon. Member and appreciate what he says. Naturally, it will take time for the owners and masters of vessels, especially foreigners, to become aware of the requirements. I think I am right in saying that the first responsibility of the enforcing authorities will be to explain the requirements to those concerned and try to get their co-operation.

The hon. Member for Brightside (Mr. Winterbottom) asked whether the Regulations in their present form were permanent. They are only a first step; they are certainly not the last word. I give the hon. Gentleman and the House the assurance that we shall keep the Regulations under review, and as progress is made in the development of devices for doing away with smoke and reducing smoke from ships' boilers and it becomes practicable to enforce higher standards, we shall certainly take the earliest opportunity to do so.

Mr. Blenkinsop: In considering the matter in the future, will the hon. Gentleman keep in mind the provisions of Section 2 of the Clean Air Act which give for factories on land, and presumably installations at sea, the seven-year special—I will not say "exemption"—treatment in connection with existing old types of furnaces and boilers? Presumably that applies also to ships. It is to be presumed that that is of very considerable assistance, and we ought to think in terms of encouraging the provision of new methods of firing where there is considerable nuisance.

Mr. Bevins: I agree that we ought to do all we can to encourage the installation of modern types of firing. There is the practical difficulty with many of the smaller craft especially that it is not possible to convert them from one system to another simply because of space limitations within the vessels themselves, but we shall certainly bear that consideration in mind.

The hon. Gentleman asked about continuous emissions. He rightly said that paragraph 3 (*a*) of the Regulations provided for limitations on continuous emissions in the case of classes 1 and 2 set out in the Schedule but not for class 3. It would have been possible to have some limitations on continuous emissions from some coal-fired ships. It would have been a longer period than five minutes; it might have been ten or fifteen minutes. We felt that so many exceptions would have been required to such a rule that for the sake of simplicity, and for the time being, it would be as well not to impose any limit at all on that type of craft.

The hon. Member had a little bit of fun about paragraph 3 (2), which says:

"For the purposes of the said schedule a vessel is not under way when it is at anchor or made fast to the shore or bottom, and a vessel which is aground shall be deemed to be under way."

For coal-fired ships there is a longer period for ships under way. This longer period is necessary for a ship which is aground for it may be working its engines and boilers at maximum capacity to get off the bottom. So the drafting, though paradoxical, provides a simple and effective way of achieving this purpose. It is a little complicated and I hope that the hon. Member understands it. I confess that I do not.

My hon. and gallant Friend the Member for Barkston Ash, with his great knowledge of shipping, said that the Beaver Committee had been rather reticent in its observations on the control of smoke emitted from ships. That is true, but I am not sure that he was right to go as far as to suggest that the Committee said little about this problem, because it was not a great nuisance. I agree with my hon. Friend the Member for Wavertree that in many ports that may be a major nuisance, and I believe that the Beaver Committee did not have much to say on the problem not only because it thought that it was a smaller problem than of industrial smoke, but, more important, because it realized the practical difficulties associated with the problem were greater than in the case of land installations.

The hon. Member for Sheffield, Brightside asked whether the provisions of Section 3 of the 1956 Act applied in the case of vessels. On reconsideration, he will see that Section 20 of the Act, which is the relevant Section applicable to ships, refers back only to Sections 1 and 2 and not to Section 3. I am advised that, for reasons which I do not want to mention now, but which I should be very glad to discuss with him later, the provisions of Section 3 do not apply to vessels.

We are bound to have difficulties, but it is our intention to keep them under review and to make such adjustments as circumstances may indicate from time to time.

Mr. Blenkinsop: In view of the Parliamentary Secretary's assurance, I beg leave to withdraw the Motion.

Motion by leave withdrawn.

Divisional News

On the 3rd July the **East Midlands Division** visited the works of Park Foundry (Belper) Ltd., at Belper. The Company is one of the Radiation Group. Members of the Division assembled at the factory in the morning for a tour of the works.

Later, lunch was served at which W. A. Ballard, Director and General Manager, welcomed the delegates. He spoke of the developments which had taken place in domestic smokeless solid fuel appliances since the last visit of the Society four years ago. The Chairman, G. E. Chamberlain, replied and thanked Mr. Ballard for the arrangements which had been made and for his generous hospitality.

A further tour of the works included an inspection of the showroom in which numerous products of the company were exhibited. Explanations of the various forms of appliance were given by the firm's executives. In the extensive foundry, members saw the processes connected with casting, assembly and finishing of the appliances. Following this a Brains Trust was held. The panel consisted of W. A. Ballard, D. R. Prothero, Technical Manager and A. F. J. Davison, Service Manager. Numerous questions were asked and answered.

The Annual General Meeting of the Division was held in the Works Canteen. The following Officers were elected: Chairman, Councillor J. Dilworth; Deputy Chairman, G. A. Hiller; Hon. Secretary, Alfred Wade; Hon. Auditor, H. N. Eardley; Scrutineers, Councillor S. Jennings and V. Wales. The Divisional Council was also elected for 1958-59.

The thanks of the meeting were expressed to the Chairman, Deputy Chairman, Hon. Secretary, Hon. Auditor and Scrutineers by T. Henry Turner.

At Park Foundry, Belper—l. to r., in front: A. Wade, G. Chamberlain, W. A. Ballard (Director and Manager) and Ald. S. Cooper

The Annual Meeting of the **North-East Division** was held in the Lecture Room of the Northern Gas Board, Grainger Street, Newcastle-upon-Tyne on 4th July. The following officers were elected for 1958-59: Chairman, Ald. B. N. Young; Vice-Chairman, P. C. G. Isaac and Ald. A. J. Best; Secretary and Treasurer, G. W. Tate; Hon. Auditor, A. A. Seaton.

A welcome to the Divisional Council was expressed by W. Sutcliffe, Divisional General Manager, Tyneside Division of the Northern Gas Board, who said that he hoped that the morning session would lead to a profitable discussion and that the visit planned for the afternoon would be instructive. Alderman B. N. Young thanked Mr. Sutcliffe for his welcome.

The Chairman then expressed his pleasure at the very good attendance, and referred to the Diamond Jubilee of the Society next year. He said that he felt that apart from that milestone much good work would be accomplished between now and that time.

Peter C. G. Isaac then spoke on "Education for Clean Air." The first

Another Group at Belper—Radiation measurement is explained by D. R. Prothero (Technical Manager) to Councillors S. Jennings and F. Barker, T. Henry Turner, R. B. Skevington and Councillor M. Hewitt

essential, he said, was to determine who should be responsible for obtaining Clean Air, and as far as helping and guiding public opinion was concerned, the National Society for Clean Air was the appropriate body. Those who made the pollution should be properly advised on how to prevent it, and Public Health Authorities should be educated in their duties.

There were three ways in which to get the business moving. They were: to hold out the " carrot " of fuel and therefore money saving, to industrialists; to use the " stick " of enforcement by legislation; to offer " sweet words " in the form of health education. An informed public opinion was absolutely essential, because half of the pollution was produced by the domestic chimney. The magnitude of the task was enormous, as was the cost of curing the trouble, yet only a small proportion of the value of the loss due to pollution would be sufficient to clean the air. Some of the approaches which Mr. Isaac thought might be made to the problem were: instruction for the householder, production of reports and pamphlets giving clear cut opinions on merits of types of fuels, and equipment, advice from local authorities, and advice from interested parties such as manufacturers.

Mr. Isaac continued by saying that senior schools should not be overlooked in the attempt to guide public opinion. As an example of teaching technique which could be used, he suggested that filter papers could be shown to demonstrate pollution, as was done for clean milk by the use of filter pads. It was important to emphasize that Clean Air began with *Us* and not the next man.

On the industrial side, no one should be allowed to operate a boiler for steam raising without a certificate of competency. It was a matter for regret that even now the number of certificates issued was woefully small, the number per annum being only about 1,000. Stoking was still regarded as unskilled and suitable for the half-wit, and the task of getting below Ringelmann 2 might well be difficult in view of the small number of certificated boiler men. On the control side, the training of professional and technical people was essential. Local people could act as the enforcement body, with more highly qualified professional personnel as the controls, under a Regional Local Authority Statutory Board. Finally, there was an urgent need for post-graduate training.

Many members took part in the very full discussion which followed and among them was Dr. J. B. Tilley, who suggested that commercial television might be used as a medium for publicity. Mr. Isaac replied to the many points raised and was thanked by the Chairman for his address.

After lunch the members visited the Howden Gas Works on the kind invitation of the Tyneside Division of the Northern Gas Board and were conducted in parties round the plant. At the conclusion of the visit the Chairman expressed the thanks of the members present for the excellent facilities provided.

The **Scottish Division,** as briefly mentioned in our last issue, held a successful annual conference in Glasgow on 22nd and 23rd May. Held in the City Chambers, the conference was welcomed by the Lord Provost, and at its first session heard the address that is recorded in full on another page, by Ian M. Robertson, of the Department of Health for Scotland. In the afternoon a new gasworks plant was visited at Dumbarton, by invitation of the Scottish Gas Board.

On the Friday the forenoon session was devoted to informative papers on " Domestic Heating by Solid Fuel," by R. M. Rowse, B.Sc., Technical Director of Smith and Wellstood Ltd., of Bonnybridge, and on " The Price, Distribution and Quality of Solid Smokeless Fuels," by A. Burton-Stibbon, Manager of the Solid Smokeless Fuels Federation. The afternoon session took the form of a discussion forum, opened with very telling addresses by women speakers, who forcefully put the woman's point of view about smokeless homes and their

Members of the Scottish Division at Dumbarton Gasworks being lined up for an official photograph

Members of the South East Division watching coke ovens being discharged at the Beckton Gasworks

problems. On the social side, the delegates were guests of the Glasgow Corporation for lunch on the Thursday, and of the Division on the Friday. John Innes, President of the Division, presided over the meetings.

A full summer session has been enjoyed by the **South-East Division.** A general meeting was held in the Caxton Hall, London, on 12th June, when the industrial provisions of the Clean Air Act were discussed. W. Combey (Oxford) spoke on " The Implications of the Second Appointed Day," E. A. Ellis (Barking) on "Smoke Observations in Practice," and L. E. Reed (D.S.I.R.) on " External Measurements of Smoke."

Visits, most of which were limited in number, and called for a ballot for places from among the members wishing to participate, were held as follows:

23*rd April*—London County Council laboratories, County Hall.

12*th May*—U.K. Atomic Energy Research Establishment, Harwell.

9*th June*—Esso Oil Refinery, Fawley.

18*th June*—British Transport Commission's Motive Power Depot, Stratford.

9*th July*—Shell Mex-B.P. Research Establishment, Sunbury-on-Thames.

16*th July*—City of London Port Health Authority, Tilbury.

23*rd July*—North Thames Gas Board's works, Beckton.

Following the visit to the railway depot at Stratford the Divisional Hon. Secretary, J. J. Matthews, was invited to compare a steam locomotive with a new diesel, by means of a trip on the footplate. He reports that after a journey to Ipswich by diesel, returning by steam, he was very favourably impressed by the former, not only on account of cleanliness and absence of smoke, but because of the superior visibility and working conditions for the crew.

THE ROLE OF OIL FUEL IN SMOKELESS ZONES

A Paper read to the East Midlands Division, March, 1958

by

A. Patterson, A.M.I.Mech.E.

CONTRARY to the popular belief the commercial use of oil did not originate in the United States of America. It began in our own country and in fact it started not very far from here. The owner of a coal mine at Riddings, Alfreton, Derbyshire, having been advised that the strange black liquid that was welling up in his mine was crude oil, persuaded a Glasgow chemist to try to put it to some commercial use. This Scotsman was Dr. James Young and the result of his efforts is reflected in the affectionate name he afterwards carried—Paraffin Young.

The paraffin that Young succeeded in producing was used as an illuminant since countless homes, farms and workshops, were still not served by gas and depended on candle light. Sperm, or whale, oil, the alternative to paraffin cost 6s. a gallon. Young was able to sell his burning oil at 1s. 8d. a gallon. It is remarkable that 100 years later, with all the changes in costs that have taken place, the price of paraffin is not very different.

Assuming that the natural oil had been produced from some kind of coal by underground heat, Young studied means of producing such oil artificially. He took out patents and established plant in Scotland to produce oil from some rich cannel coal which had been discovered in the neighbourhood a few years earlier.

The supply of this bituminous coal being limited, Young turned to oil shale mined in the Lothians and founded an industry which is still operating today.

Young's original investigation at Alfreton took place in 1847 and he was exporting paraffin to the United States long before Edwin Drake struck oil for the first time at Titusville, Pennsylvania, in 1859.

Paraffin Young started a revolution in lighting; now 100 years later we are in the middle of another revolution in heating our homes, also depending on oil. This is being done in two main ways—through portable but highly efficient heating appliances burning refined paraffin of a quality that would have amazed Dr. Young; and through domestic oil-fired hot water central heating installations.

Our subject today is " The Role of Oil Fuel in Smoke Control Areas " and it might not be inappropriate here to spend a few minutes discussing these areas. According to Section 11 of the Clean Air Act, which came into force on the 1st January, 1957, Local Authorities can declare the district of the local authority or part thereof to be a smoke control area. Subject to any exemptions or limitations in force it is an offence to emit smoke within these areas unless the person charged with the offence can prove that an Authorized Fuel was being used. But this does not mean that other fuels cannot be used. The point to note is that any fuel—not merely an "Authorized Fuel "—can be burned in a smoke control area provided smoke is not emitted.

Oil fuel is not included in the list of Authorized Fuels but it has been dealt with by a separate order. Section 11 of the Clean Air Act gives the Minister power to exempt any class of " fireplace " subject to certain conditions—fireplace in this context meaning any place in which fuel is burned. The Minister exercised his power in an Order in March 1957 which exempted " fireplaces " specially designed or adapted for the combustion of liquid fuel provided they are installed, maintained and operated so as to avoid the emission of smoke. This order is statutory Instrument No. 541 and is entitled " The Smoke Control Areas (Exempted Fireplaces) Order 1957." Oil therefore by virtue of this order is in effect singled out for specific exemption because of its clean burning properties.

Thus the Clean Air Act in no way forbids the installation of oil burning equipment in Smoke Control Areas or by-law areas provided the equipment complies with those conditions regarding installation, maintenance and use. This point was underlined in a Parliamentary answer given in April, 1957 in which the Parliamentary Secretary to the Ministry of Power stated " The smokeless fuel requirements under the Clean Air Act will ultimately be met by coke, other solid smokeless fuel, electricity, gas and oil."

The term " Fuel Oil " covers the whole range of petroleum products from the distillates, Gas Oil or Diesel Oil, to the heaviest residual oil. You will sometimes see the expression "Crude Oil " used wrongly to describe Fuel Oil. Crude oil is the oil as it emerges from the well and is normally a low flash black liquid. This crude oil is taken to refineries and is the source of all the various petroleum products and chemicals.

One of the basic methods of refining is by distillation and by this process the various fractions are distilled off in order of their boiling ranges. Thus petrols are one of the lighter fractions whereas kerosenes and gas oils are intermediate distillates, whilst the residual fuels consist largely of the residue of the crude oil after the distillates have been taken off.

Within the range of the Fuel Oils—that is between Gas Oil and the heaviest residual—there are several grades and each grade has a name to distinguish it from the other. It might be thought that, as with solid fuels, the calorific value would be the best method of comparing one grade with another, but when it is remembered that between the extremes there is only a difference of about 6 per cent., it can be appreciated that some other method of comparison had to be adopted.

The classification used compares grades by their viscosity. The definition of viscosity is rather complicated to me so I hope the physicists here will forgive me if I convert it into every day language and say that it is the measurement of the ability to flow, or the fluidity of the oil.

Commercial instruments have been invented to give a relative value of viscosity and in the United Kingdom we use the one that was invented by Sir Boverton Redwood and which bears his name—the Redwood Viscometer. Basically all these instruments allow a certain quantity of the oil under test to pass through a fixed orifice and the time taken to do so, in seconds, is the viscosity. There is however, one important variable and that is temperature. As the temperature rises so the oil becomes less viscous or flows more easily, thus a standard temperature had to be fixed when measuring viscosity so that the results were comparable. The temperature was fixed at 100°F. so that in the United Kingdom a Fuel Oil would have a viscosity of so many seconds Redwood 1 at 100°F.

The grades available in this country with their common names and appropriate viscosities are:

Grade	*Seconds Redwood 1 at 100°F.*
Gas Oil	34
Light Fuel Oil	200
Medium Fuel Oil ..	950
Heavy Fuel Oil	3,500

With the heavier or more viscous grades of oil fuel a certain amount of heating is necessary during storage and prior to burning to ensure that they are at a viscosity that can be pumped easily and subsequently atomized.

Oil is composed of thousands of compounds of hydrogen and carbon and combustion of oil consists of combining these compounds with oxygen from the atmosphere to form water (H_2O) from the hydrogen and carbon dioxide (CO_2) from the carbon. Favourable conditions must be established before such a combination can take place. These conditions are:

1. Sufficient air must be available.
2. Intimate mixing of air and oil must take place.
3. A high temperature zone must be available to assist these elements in obtaining rapid and complete combustion.

The first condition can be easily satisfied; the third condition is fulfilled when ignition is established, the high temperature zone being the flame itself.

It is in meeting the second condition—the intimate mixing of the air and oil—that the oil-burner designer must concentrate his efforts. Every particle of oil must get its due allocation of air, and when it is remembered that these particles are consumed in a very short time—usually less than 0.2 seconds—we can readily appreciate how difficult the task is.

To make the intimate mixing of oil and air easier the oil is atomized. This word was coined a long time ago, certainly before we thought seriously about atomic bombs and nuclear power stations, and its meaning is not quite as exacting as the tag implies. It is the physical fragmentation of the oil or breaking it up into a very fine spray, so that the maximum surface area of the soil is offered to the oxygen in the air.

It is possible, knowing the analysis of the oil, to calculate the theoretical quantity of oxygen, and hence air, required for complete combustion. However, such perfect conditions are rarely met and usually air in excess of that theoretically required must be supplied. This excess air must be kept to a minimum. This is apparent when we remember that after coming into contact with the material or surfaces to be heated this air is discharged into the stack and any heat remaining is wasted, at least so far as the heating process is concerned. Thus, as is customary in Engineering, we compromise—we must supply sufficient excess air to ensure that combustion is complete but not too much in case we reduce the overall efficiency of the plant. Usually 30 per cent. excess air is about the right quantity and this will result in a CO_2 in the dry flue gases of 12 per cent. At 30 per cent. excess air, 1 lb. oil would require about 18½ lbs. air or about 240 cu. ft. in volume at 60°F. and at atmospheric pressure.

We have said that to get the maximum useful heat from our fuel during combustion we must keep the quantity of excess air to a minimum or, as it is usually described, we must obtain the highest CO_2 possible in the exit flue gases. This is not the entire story as there is another factor and in these days of clean air it is an important one—we must not make smoke! Thus the criterion for good combustion is a high CO_2 and no smoke.

Let us investigate what causes a burning fuel to smoke. You will remember earlier, when we discussed combustion, our endeavour was to provide the carbon and hydrogen with oxygen from the air to form carbon dioxide and water vapour. Now if we do not give the carbon sufficient air or, as is much more likely, the air is not properly mixed, some of the carbon will remain unburned and small particles of this carbon, carried by the chimney gases, will cause black smoke. This black smoke is unburnt fuel and is of course a waste of money.

The Beaver Committee in their report gave an estimate of the pollutants discharged by various fuels. Little or no emission of smoke or grit was attributed to oil fuel and, for this reason alone, there is good reason for its increasing use as a fuel that can be burned without smoke. Whilst it is true to say that a large majority of oil-fired installations can, and indeed do, operate without smoke, it must be agreed that oil fuel is capable of making heavy smoke under certain conditions. This degradation of combustion is something that the ships of the Royal Navy have put to good use on many occasions. However, with reasonable care and proper attention it is not merely possible, but also easy, to make oil fuel burn smokelessly and a smoking chimney is neither necessary or excusable.

According to the Act dark smoke means smoke which, if compared in the appropriate manner with a chart known as the Ringelmann Chart, will appear to be as dark as or darker than shade 2. This is very dark smoke.

The Ringelmann Chart is a visual method of determining smoke concentration with a variation of smoke density between the various numbers. The smoke density variation between these numbers is great and the Shell Oil Company have developed a more sensitive method of smoke measurement which will give a rapid result and covers a range of numbers from 0 to maximum 9. Shell Smoke No. 9 is under Ringelmann 2.

A sample of the combustion gases is drawn by a motor-driven vacuum pump through a disc of filter paper for a period of one minute. The pressure drop maintained across the filter paper to 3″Hg. When the vacuum pump is started a clockwork mechanism switches it off after one minute duration. Thus by maintaining a constant suction for a measured period of time the quantity of gases drawn through the filter paper is the same for each sample taken. The filter paper is discoloured during this test and the degree of discolouration is matched against a comparator scale which consists of circles of colour ranging from 0-white to 9-black. The nearest matching shade is designated the Shell Smoke No.

The Shell Smoke No. 6 is the lowest concentration of stack solids which is just visible at the stack under favourable conditions. Thus we can distinguish between five shades or ten half shades of " smoke " below the least which is visible to the naked eye.

Let us again turn to our combustion discussion. The criterion of good combustion is the highest possible CO_2 without making smoke. We are often asked to define what is meant by a good burner, and my answer is: A good burner should operate within the manufacturer's specified oil consumption with flue gases having a minimum CO_2 content of 11 per cent., and a maximum Shell Smoke, No. of 5. This is a very high standard and it is a credit to the British Oil Burner Manufacturers that so many burners satisfy these conditions.

THE WARREN SPRING LABORATORY

The new D.S.I.R. laboratory, which is to take over much of the work of the Fuel Research Station, and which is now being built at Stevenage, will be called the Warren Spring Laboratory. The name is taken from a lane that used to run across the site on which the laboratory is being built.

It will be recalled that the Council for Scientific and Industrial Research have expressed the view that the Warren Spring Laboratory should be a versatile station, free to do work on any subject which becomes important for the nation and which cannot be fitted into the programme of another research body.

It has already been decided that work will be carried out on air pollution; on the synthesis of oil and chemicals from carbon monoxide and hydrogen; and on mineral processing.

The new station will, in addition, be free to take up any research requiring staff and facilities of the type that are being provided.

The title of the Director, Mr. S. H. Clarke, C.B.E., will be the " Director of the Warren Spring Laboratory." Under a new arrangement a Steering Committee will replace the Research Board which was responsible to the Research Council of the D.S.I.R. for the research programme of the Fuel Research Station. It is an essential feature of the new arrangement that the Steering Committee is a full committee of the Research Council and that there will be a direct link between the two bodies, because the Chairman of the Committee is a member of the Council.

In addition to the Chairman there will be four members of the Committee. Two will be from industry and will have experience in research management. The other two members will be the Secretary of the Department of Scientific and Industrial Research and the Director of the Laboratory. The Committee is empowered to set up specialist sub-committees as necessary, to advise on the different fields of research covered by the Laboratory.

The Warren Spring Laboratory Steering Committee is as follows:

Chairman: Sir Harry Jephcott, D.SC., F.R.I.C.

Members: Dr. R. Holroyd, M.SC., PH.D. D. A. Oliver, C.B.E., M.SC.(ENG.), F.I.M., F.INST.P. The Secretary of the D.S.I.R. The Director of the Warren Spring Laboratory. Their appointment takes effect immediately.

Sir Harry Jephcott is Chairman of the Research Council. He is Chairman of Glaxo Laboratories Ltd. Dr. Holroyd is Deputy Chairman of Imperial Chemical Industries Ltd. Mr. Oliver is Director of Research of the B.S.A. Group Research Centre.

Hydraulic Mining

A completely new system of getting coal is to be tried out by the N.C.B. in a first experimental installation of hydraulic mining at Trelewis Drift Mine near Treharris, Glamorgan. The coal is extracted by the power of high velocity water jets directed at the seam from a powerful hose, called a monitor. When the coal is broken down, the jet is used again to clear the floor of the working place and to drive the coal along to the point of collection.

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DRIVE FOR CLEAN AIR IN CZECHOSLOVAKIA

In an article under the above title in a Czech technical journal the present position of Air Pollution in Czechoslovakia is reviewed, and ways are suggested for furthering the improvement of the atmosphere in industrial towns and districts.

With growing industrialization, with coal as a power basis, the increased pollution of the air by dust, fly-ash, and gas exhalations is inevitable. The most affected areas are the densely populated districts of Prague, Ostrava, Usti and Karlovy Vary.

Most serious is the abatement or recovery of gas exhalations in the Usti area. One chemical plant discharges into the atmosphere yearly 48,000 tons of sulphur dioxide. Other dangerous effluents are Chlorine, Hydrogen Sulphide, Nitrogen and Phosphorus Oxides, and Sulphuric Acid. Of crucial importance is the development of a method for the removal of sulphur, with low operational cost characteristics.

The overall improvement of conditions in this area, including the mitigation of negative effects of gaseous effluents on agricultural production, vegetation, woods and buildings is the object of special governmental decree.

In the " black " Ostrava coal and steel basin, a special commission was set up to draw a complex plan for a radical improvement of the atmosphere based on the study of atmospheric and topographic conditions, hygienic and biological problems, evaluation of sources of dangerous pollution, technical problems of abatement and design questions. The commission's work was checked and adjusted by a conference on the spot held at the end of 1957. It is hoped that thanks to far-reaching investment and organizational measures the dust emissions of the present sources will be reduced by 66 per cent. in about 5 years.

As mitigating measures are more conveniently and with less cost solved at newly-built plants than at reconstructions, a governmental decree is in preparation making obligatory dust collecting and gas cleaning measures in all plans for long-term industrial investment in the whole territory of the state. Big tasks will be imposed in air pollution control with the erection of new steam power plants of great unit size and overall performance with low grade coal firing, and big chemical and metallurgical plants with new technological processes.

The tasks of the Clean Air Campaign in Czechoslovakia are summarized as follows:

In Research: Systematic study of meteorologic and climatic conditions with respect to dangerous pollutants; the solution of economic disposal of collected dusts and components removed from gas exhalations; the solution of the problem of removal of sulphur dioxide and trioxide; to assure all necessary measurements to gain the starting parameters of air pollution control equipment.

In Development: Development of equipment for continuous automatic control of dust-collecting and gas cleaning equipment; utilization of fly-ash in large-scale production of building materials.

In Design: Effective control of design in technical and economic respects of all dedusting and gas cleaning equipment (already in the first stage of design); regular field control of air pollution by Control Stations.

Operational Measures: To put the operation and maintenance of dedusting equipment on a higher level.

Standardization: To lay down permissible concentrations of solid and gaseous pollutants in the atmosphere with respect to the country's industrialization.

Planning: To consider plans for development of industrial sectors in such a way as to prevent the growth of air pollution in most exposed areas; to base the selection of sites for new industrial plants and residential quarters on the results of topographic, climatic and meteorological studies. To earmark for power stations and big industrial plants a long-term fuel basis; to consider possibilities for the use of gas in boiler plants and use of gas from degasification of mines. To replace steam locomotives by diesel or electric traction on sidings, and to mechanize the town cleaning services. So far as residential buildings are not to be heated distantly from steam power stations, to provide household grates with more valuable fuel.

Organization: To set up a special body to control, co-ordinate and unify the actions of all sections taking part in air pollution control measures until new equipment starts to operate.

SMOKE PREVENTION ABSTRACTS

306. Dust Collecting Equipment. Samfield, M. (Cost Eng., **2**, 106–109, Oct. 1957). Factors influencing the selection of the proper dust-collecting equipment are dust loading, volume of gas handled, range of particle sizes, degree of collection desired, and nature of the operating conditions. Operating and maintenance costs of specific dust-collecting equipment are included. (D.S.I.R. 736.)

307. Scrap Refinery Controls Smoke with Water Scrubber. Bykowski, L. (Iron Age, **180,** 96–97, 15 Aug. 1957.) A plant installed to clean the fume from a scrap-melting furnace is described. It is a Hydro Precipitator Scrubber in which the gases are wetted and forced through a water bath from which the solids settle and the gas escapes. Capacity is over 20,000 cu. ft. per min. (D.S.I.R. 738.)

308. Versatility of Oxidation Catalysts for Industrial Air Pollution Control. Houdry, J. H. and Hayes, C. T. (J. Air Pollut. Contr. Ass., **7**, 182–186, Nov. 1957.) Examples of the use of catalysts in the presence of materials usually considered to be deterrents to catalytic oxidation are discussed. Applications described include the oxidation of: the resinous contaminants emitted from the binder used in making Fibreglass, the waste gases of catalytic cracking plants, the tail gases from carbon black manufacturing processes, and the tail gases from a phthalic anhydride process. The catalytic element used in all these applications is the Oxycat and its design and operation is described. (D.S.I.R. 746.)

309. Diesel Engine Performance. A Technique for Reducing Smoke and Improving Output. Alperstein, M. et al. (Auto. Engr., **48,** 22–31, Jan. 1958.) The technique described represents a step away from the diesel engine in the direction of the Otto engine. It is a step that preserves all the diesel advantages and alleviates two disadvantages, incomplete mixing of air and fuel and late combustion caused by long ignition lag. Broadly, the method consists in introducing part of the fuel in a fine mist or fume into the intake manifold while the remainder is introduced in the conventional manner through the high pressure injection system into the cylinder near top dead centre position of the piston. (D.S.I.R. 749.)

310. Developments in Solid Fuel-Burning Equipment in Air Pollution Control. Grossman, P. R. (J. Air Pollut. Contr. Ass., **7,** 222–226, Nov. 1957.) The design of coal-fired boiler units that reduce atmospheric pollution is reviewed and the problems associated with obtaining smokeless combustion and optimum efficiency are considered. (D.S.I.R. 750.)

311. Improvement of Domestic Stove Efficiencies by Flue Dampers. Fox, L. L. and Whittaker, D. (J. Inst. Fuel., **31,** 297–303, July 1958.) This paper considers the case for fitting flue dampers to stoves. It is shown experimentally that the use of a flue damper increases the efficiency of a stove, whether its firedoors are open or closed. The loss of efficiency caused by leaky firedoors when these are closed can be wholly restored by a flue damper. An additional and comparable loss of efficiency is shown to occur when air is allowed to by-pass the fuel bed through an internal gap of type often incorporated deliberately in the design; a flue damper does not reduce this loss. (Authors Abstract.)

312. Principles of Gas Cleaning. Kleinschmidt, R. V. (Amer. Soc. Mech. Engrs. Preprint No. 57-A-270, 1957.) A discussion of types of impurities to be removed; concentration of impurities in (1) the initial gases, and (2) the final cleaned gas: the sizes of particulate impurities; the properties of the gas to be cleaned; and methods of gas cleaning. (B.C.U.R.A.)

313. Clean Air Act and Coke Oven Operation. Cellan-Jones, G. (Coke and Gas, **20,** 71–75, Feb. 1958.) For coke oven works with established units, the following modifications to relieve oven door gas " bleeding " could be applied: an increased depth of door plug with a gas exhaust channel (Goldschmidt); the interconnexion of adjacent standpipes, or a brickwork crown flue, static or mobile; and the fitting of self-sealing hopper chutes to the charging car. For new plants the following features could be considered: increased superficial area of brickwork at end flue of the wall, with intensified heating; pyrometric control of wall temperatures to ensure complete carbonization of charge; and a more determined effort to control the coke quenching operation. (D.S.I.R.)

314. Obnoxious Odours and How to Get Rid of Them. Turk, A. (Industr. Wastes, **3,** 9–14, Jan./Feb. 1958.) The methods of odour control considered include: dispersal, combustion, adsorption, absorption (all methods of odorant elimination) and modification (referring to the modification of odour perception). Stack dispersal and direct fired combustion are briefly outlined but catalytic oxidation and adsorption by activated carbon are described in detail. The use of synthetic zeolite adsorbants and of absorbtion methods is also discussed. The problems associated with the control of odours on a perceptual basis by the admixture of a non-reactive odorous atmosphere or gas stream to other vapours are considered. (D.S.I.R.)

315. Effect of Possible Smog Irritants on Human Subjects. Sim, V. M. and Pattle, R. E. (J. Amer. Med. Assoc., **165,** 1908–1913, Dec. 1957; abstr. in Industr. Hyg. Dig., **22,** 30, Jan. 1958.) A large number of men were exposed for periods up to 60 minutes to sulphuric acid mist, sulphur dioxide, and various aldehydes. The effects of adding magnesium oxide smoke and ammonia to sulphuric acid mist and sulphur dioxide were also studied. The main effects of sulphur dioxide and sulphuric acid were an increase in airway resistance and causation rates. Two subjects exposed to sulphuric acid mist developed long-lasting bronchitic symptoms. Adding steam to sulphuric acid mist (which causes the particles to enlarge) increased the irritancy of the mist. Adding magnesium oxide smoke to the mist in quantities in excess of the equivalent of the acid present had no effect on the irritancy of the mist. Adding ammonia to the mist annulled its irritant properties. Adding magnesium oxide smoke or ammonia to an atmosphere containing sulphur dioxide removed the irritant and bronchoconstrictive properties of that atmosphere. Acrolein and crotonaldehyde were highly irritant. Acetaldehyde, propionaldehyde, butyraldehyde and isobutyraldehyde were almost non-irritant. The properties of formaldehyde were intermediate between those of these two groups. (D.S.I.R.)

316. Smoke Free Incineration of Liquid Wastes and Sludges. West, R. F. (J. Inst. Public Health Eng., **57,** pt. 2, Apl., 1958, 91–97.) Among problems of refuse disposal now causing concern is the destruction of oily wastes (liquids, oil-soaked solids, sludges and their associated containers) from paint factories, printing ink works and chemical factories. Most of these wastes can be incinerated without difficulty and without nuisance, producing an innocuous residue which can be tipped with safety. The purpose of the paper was to discuss some problems of this kind and the solutions arrived at. The incineration of the materials described is discussed and is concluded with descriptions and illustrations of typical installations. It is stated that all these plants operate in accordance with the requirements of the Clean Air Act.

Correction

Fleming Radio (Developments) Ltd., have drawn our attention to an error in the prices mentioned for their automatic air pollution recorder, which was reviewed in our Summer issue, page 262. The prices should read: Pollution Recorder, £125; Read-out Unit, £75.

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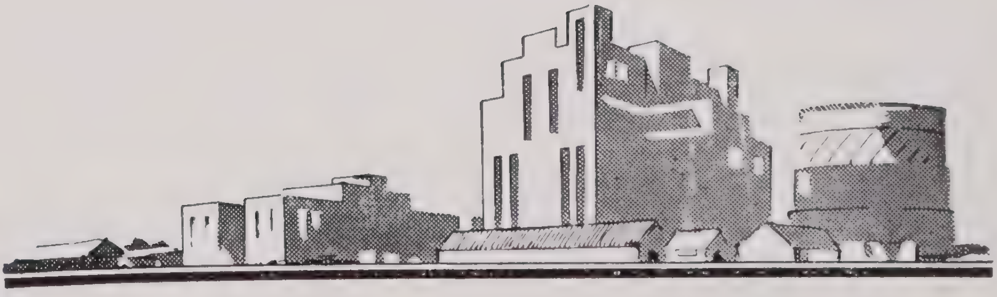

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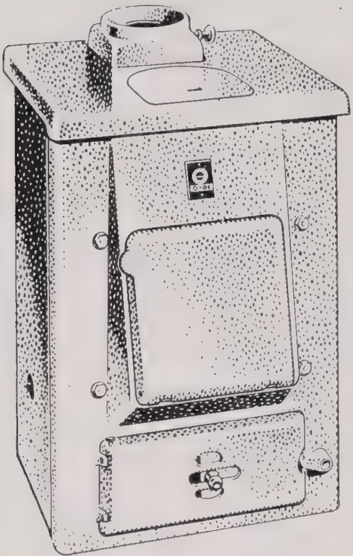

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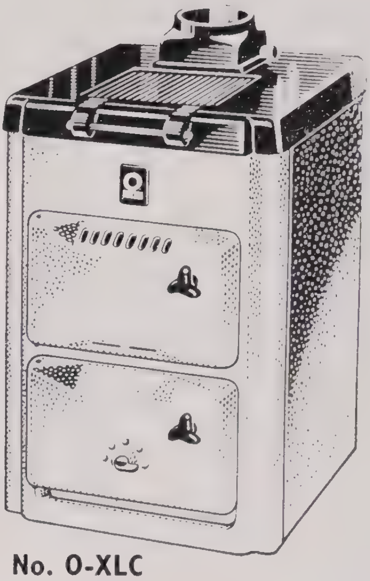

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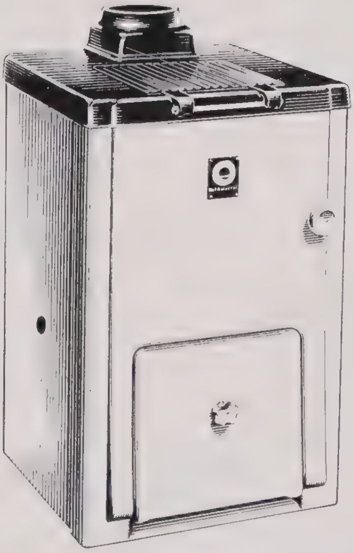

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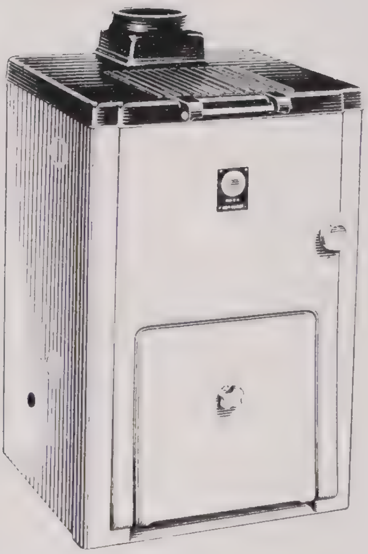

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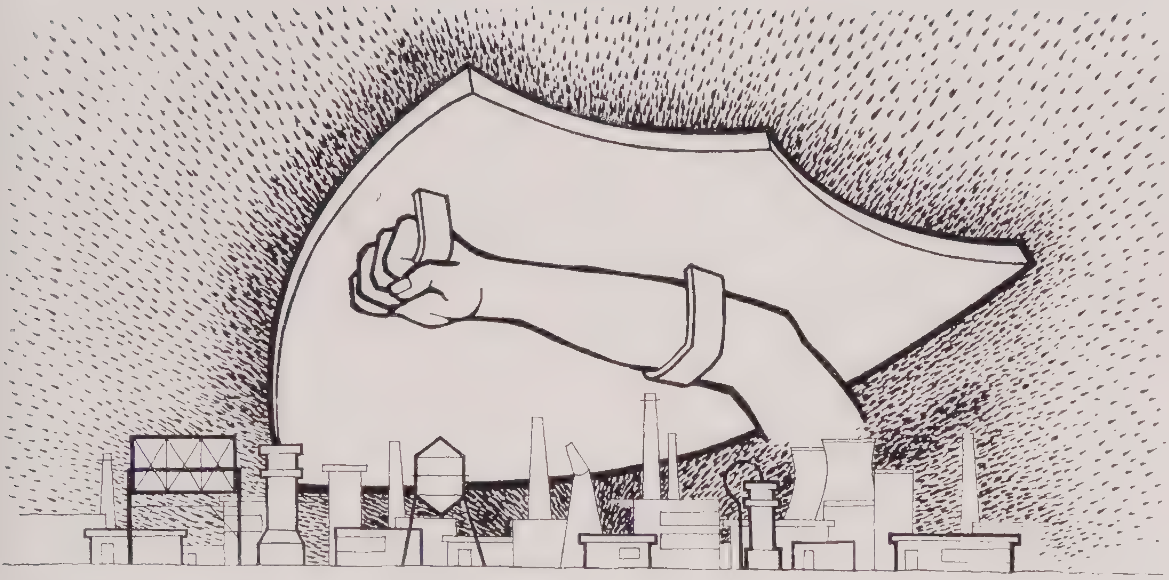

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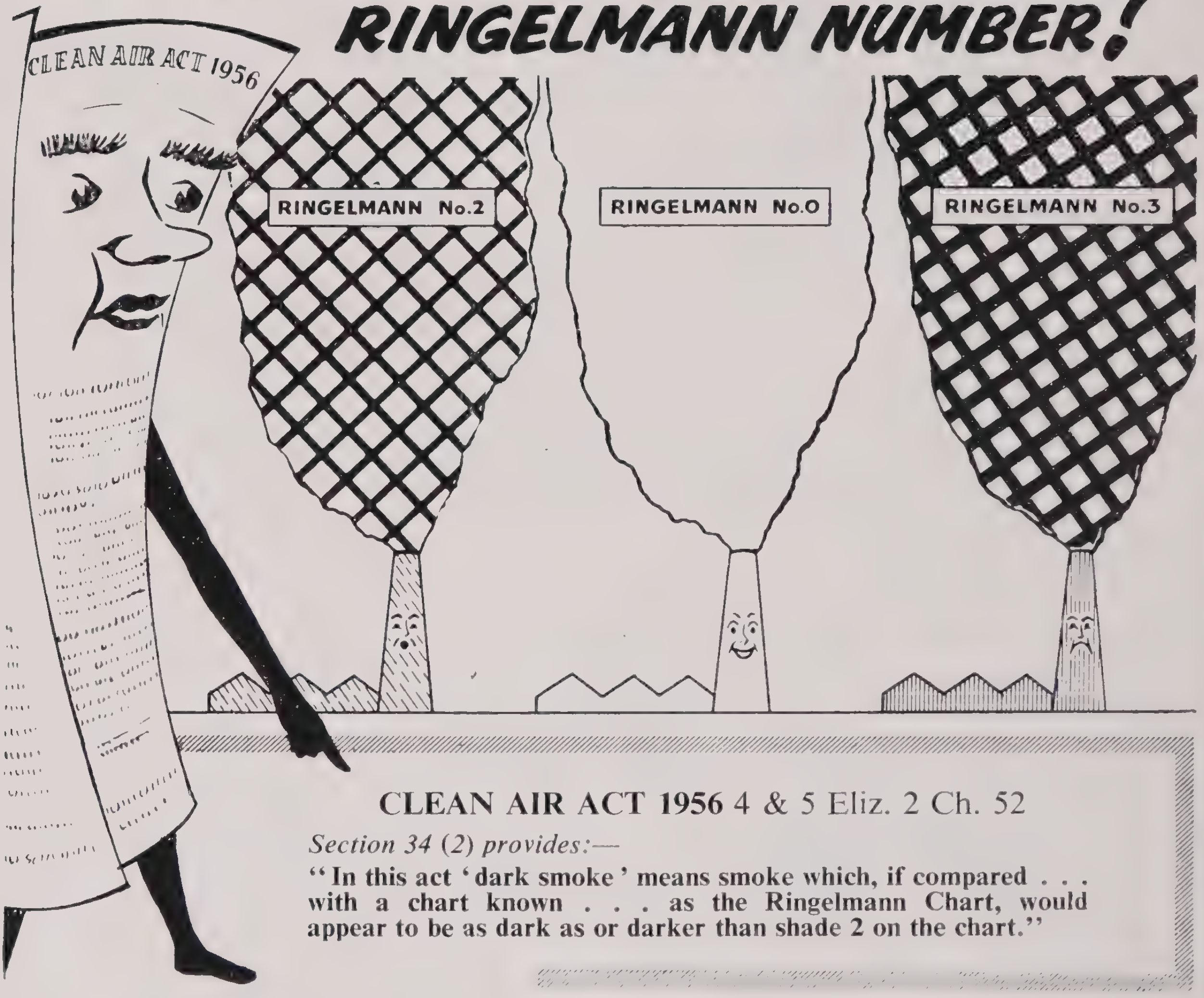

CLEAN AIR ACT 1956 4 & 5 Eliz. 2 Ch. 52

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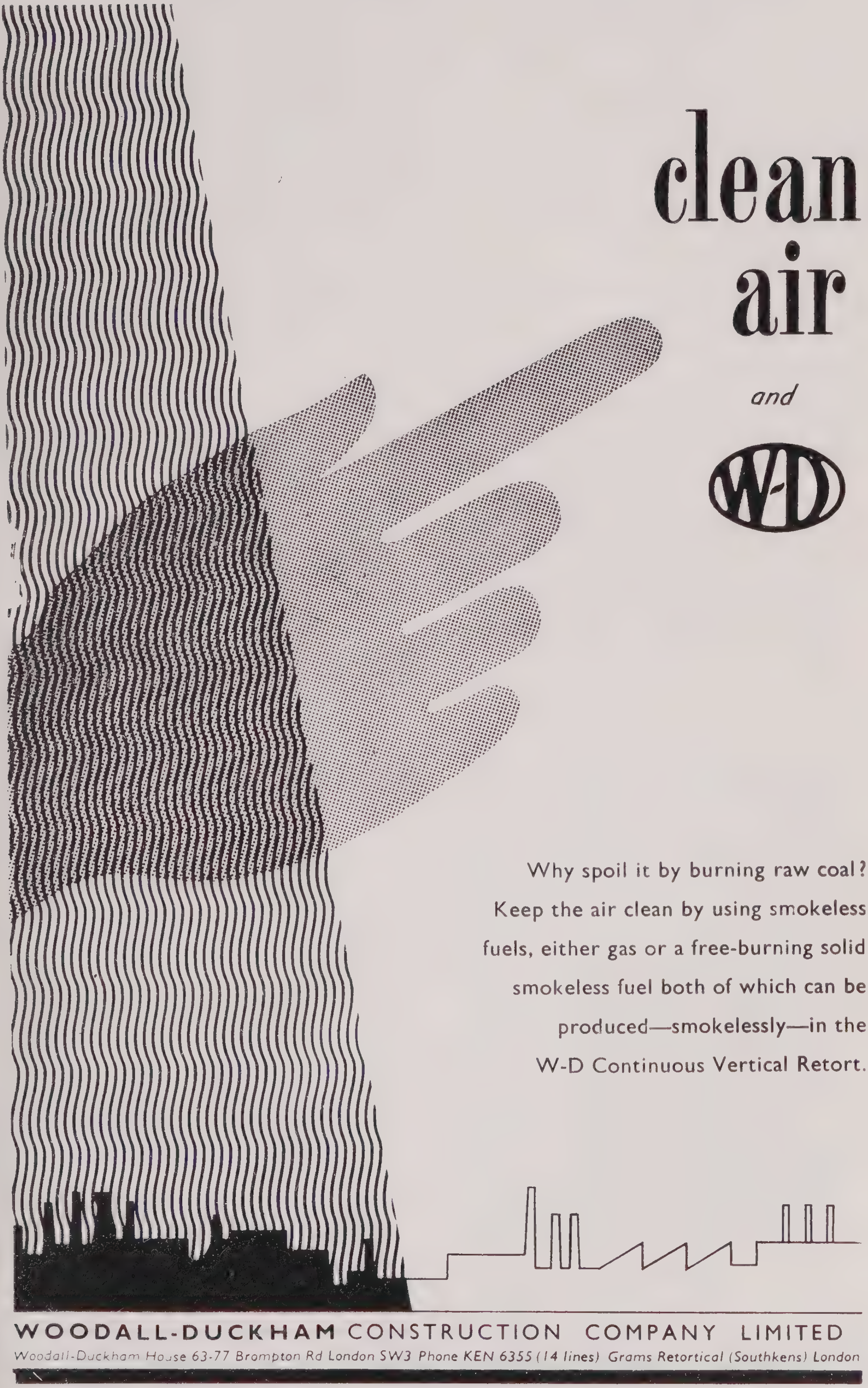

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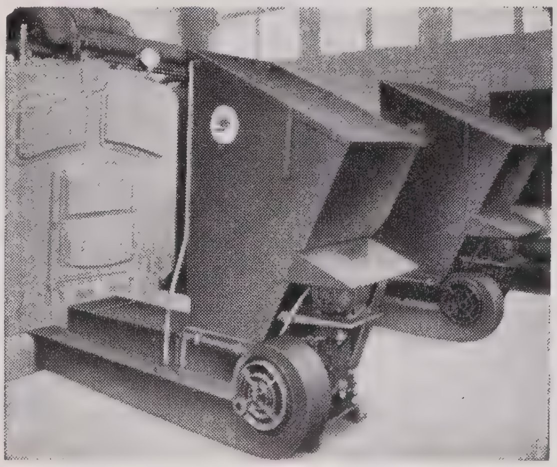

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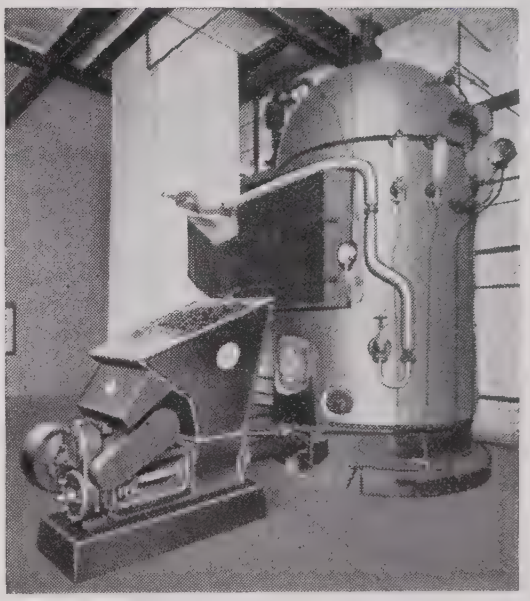

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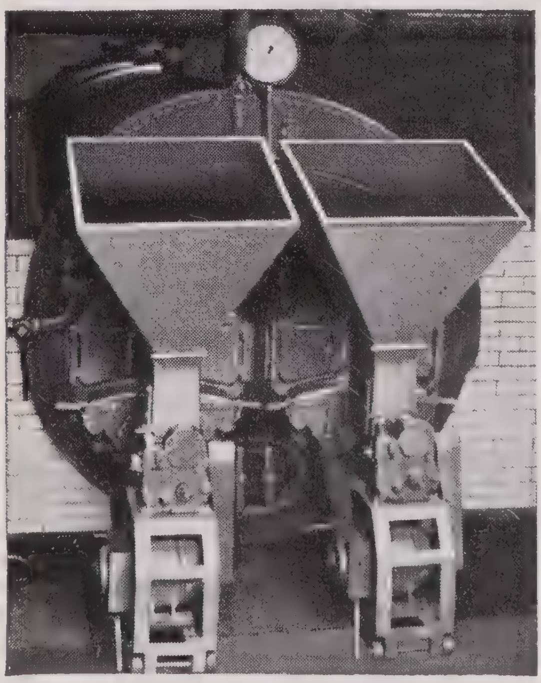

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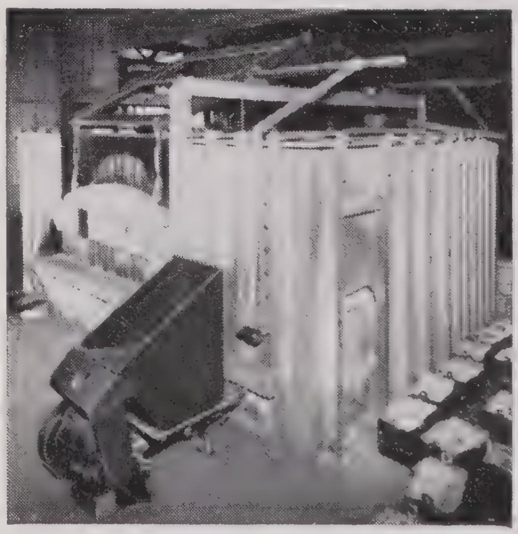

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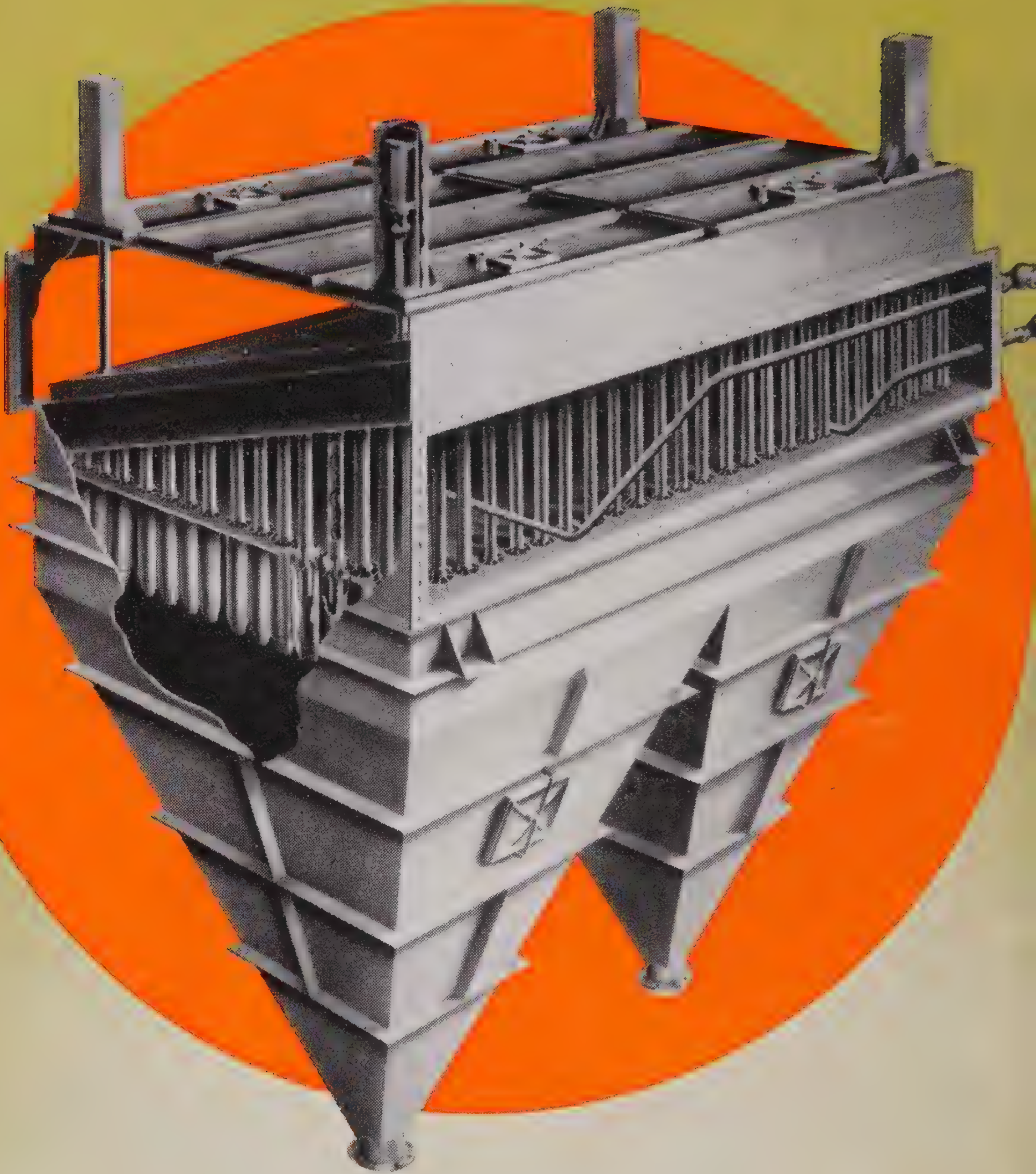

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JOURNAL OF THE
NATIONAL SOCIETY FOR CLEAN AIR

No. 108 ⋆ WINTER 1958 ⋆ 2/-

In this Issue

Llandudno Conference—Address by the Rt. Hon. Henry Brooke, M.P. ✶ Smoke Control Areas—Progress Report ✶ Clean Air Act Cases ✶ Speech by the Rt. Hon. Lord Mills ✶ Des Voeux Memorial Lecture, by Sir William Holford ✶ Etc., Etc.

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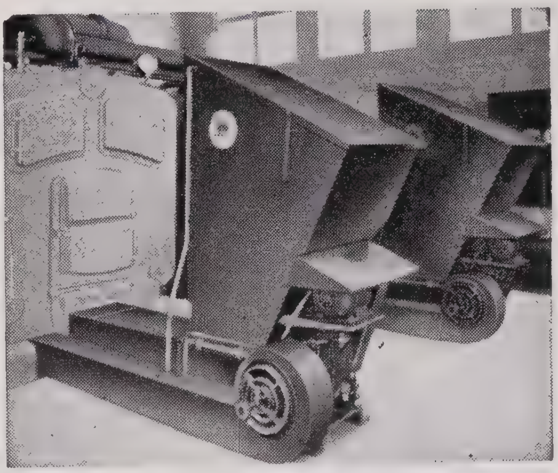

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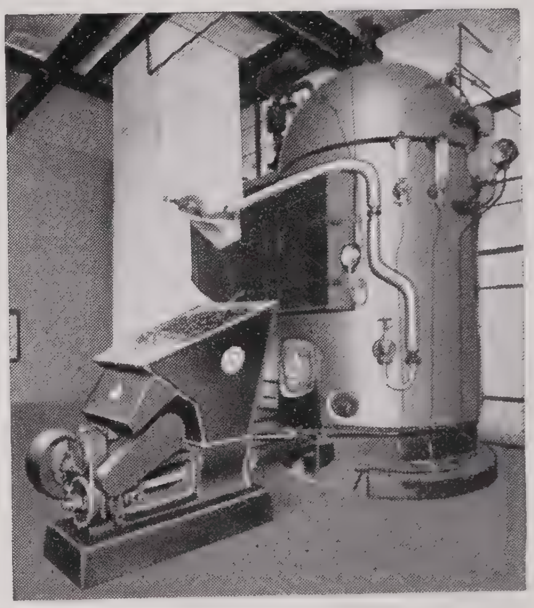

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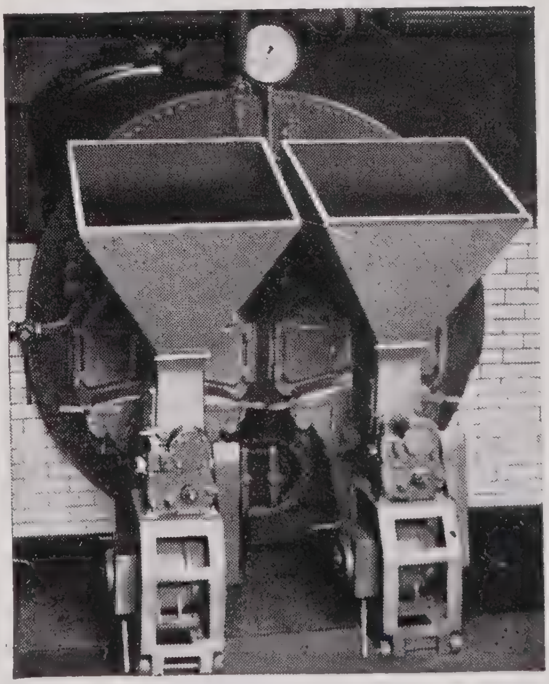

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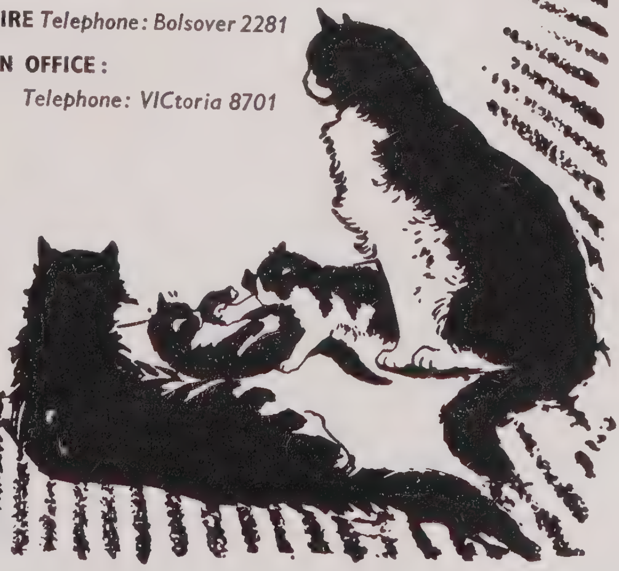

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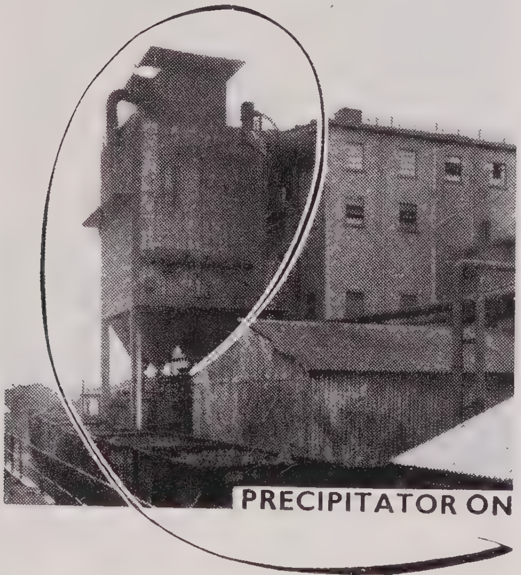

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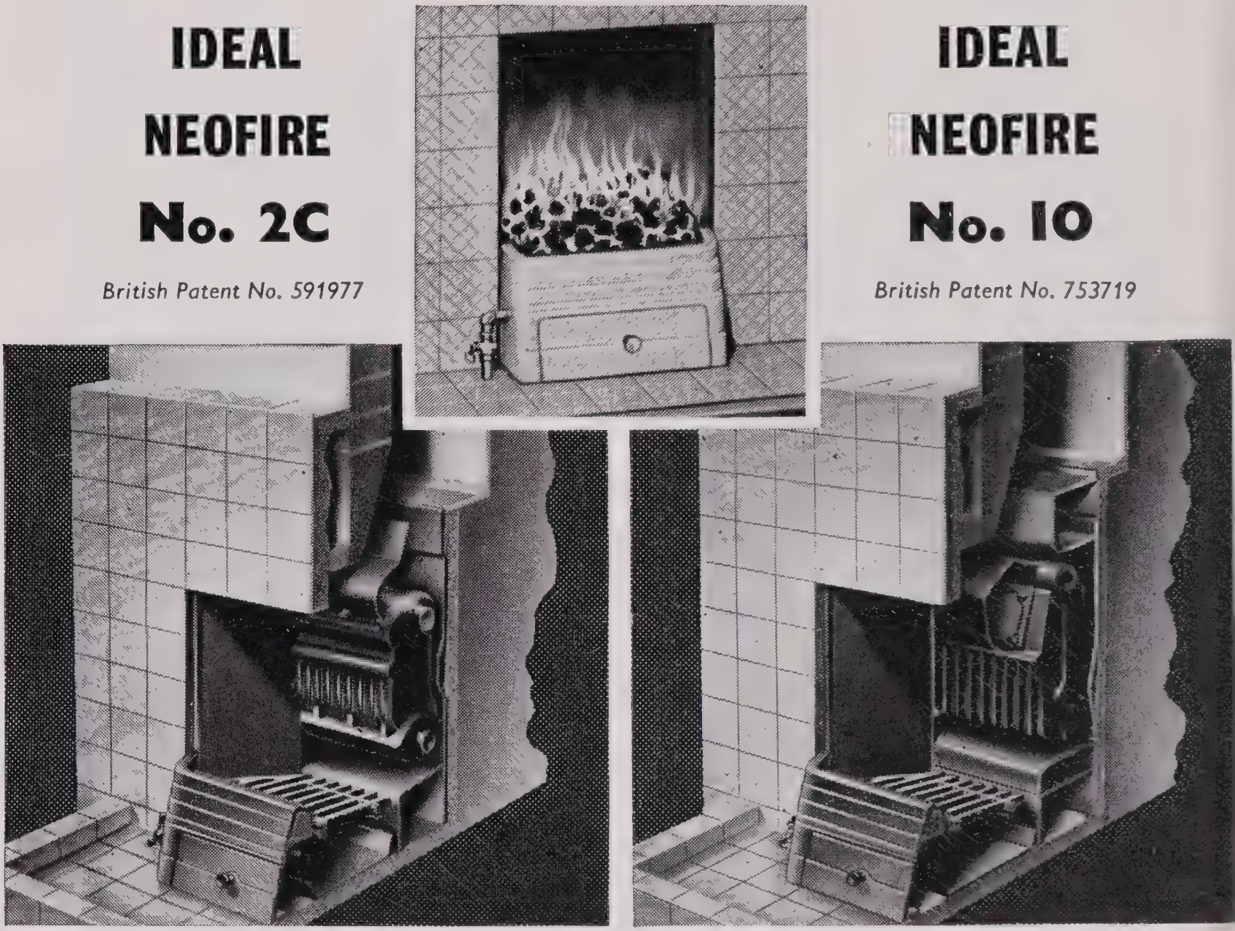

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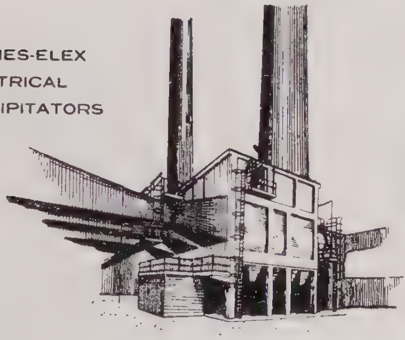

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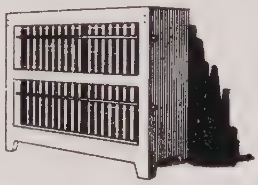

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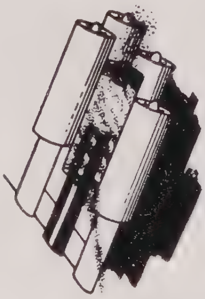

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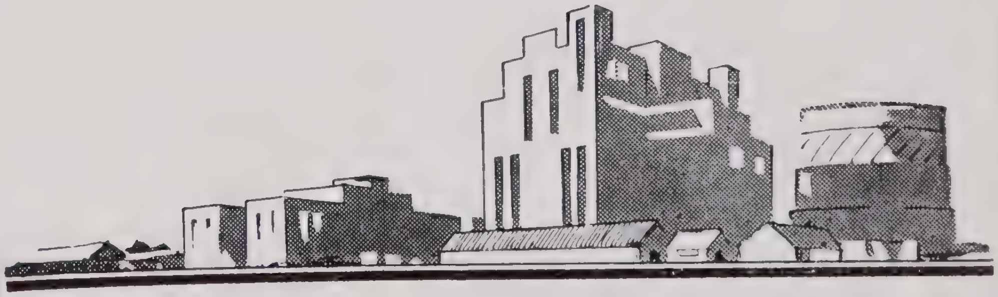

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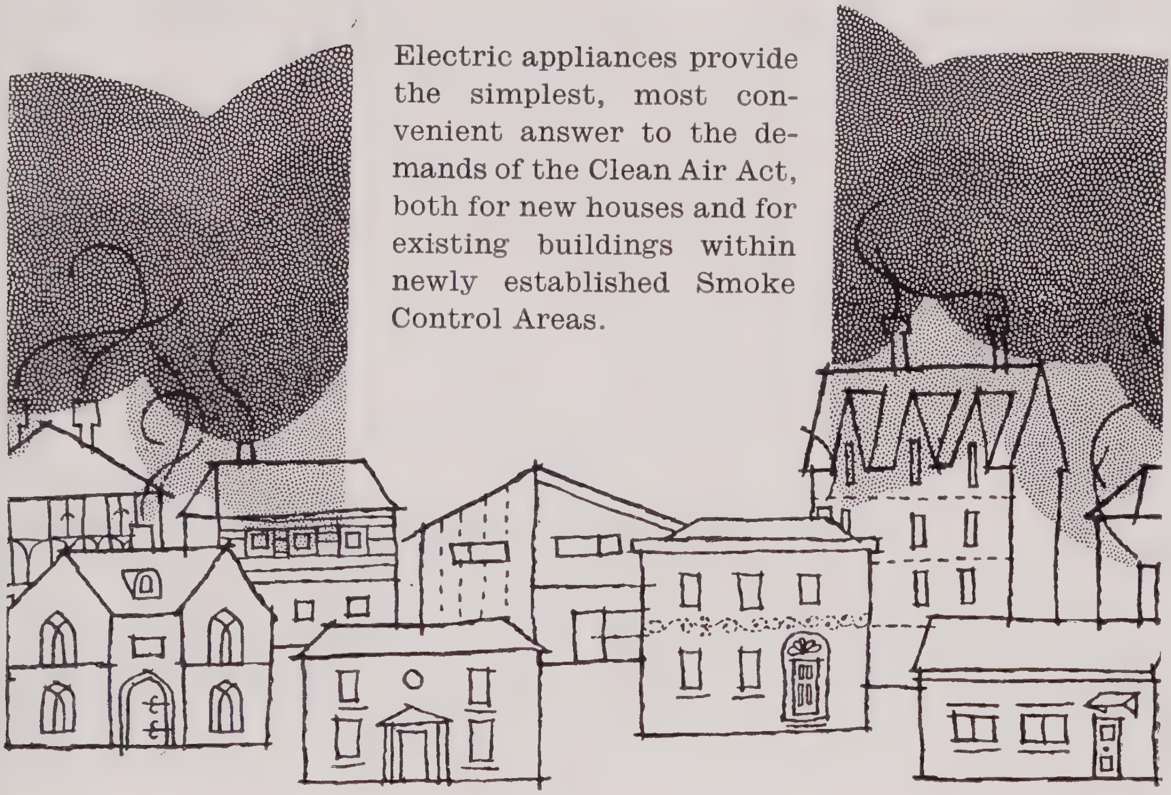

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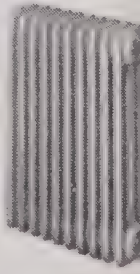

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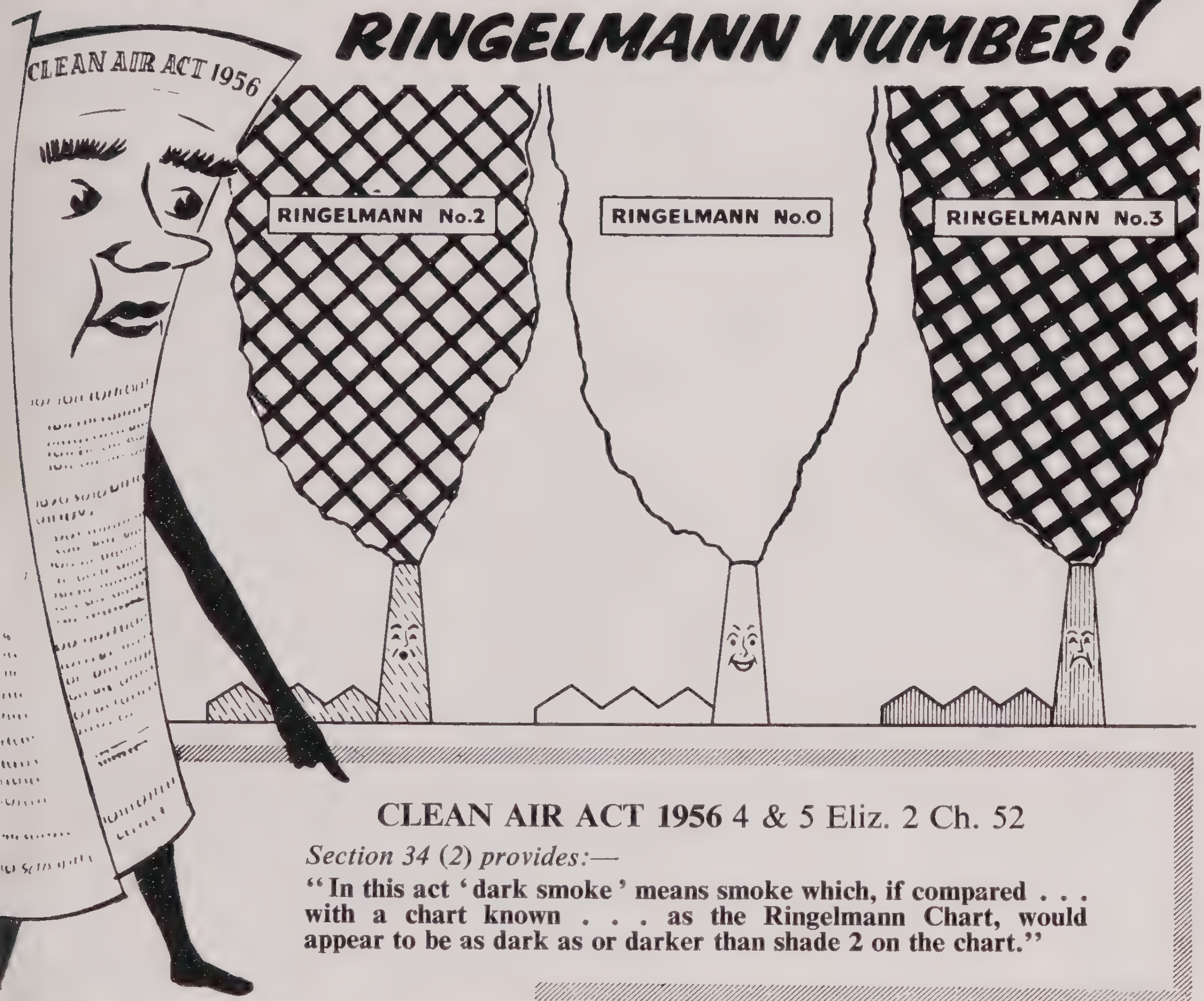

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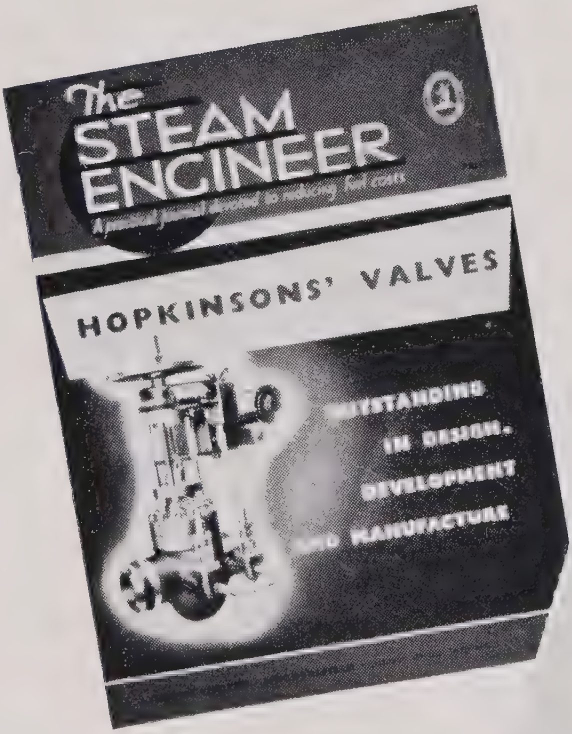

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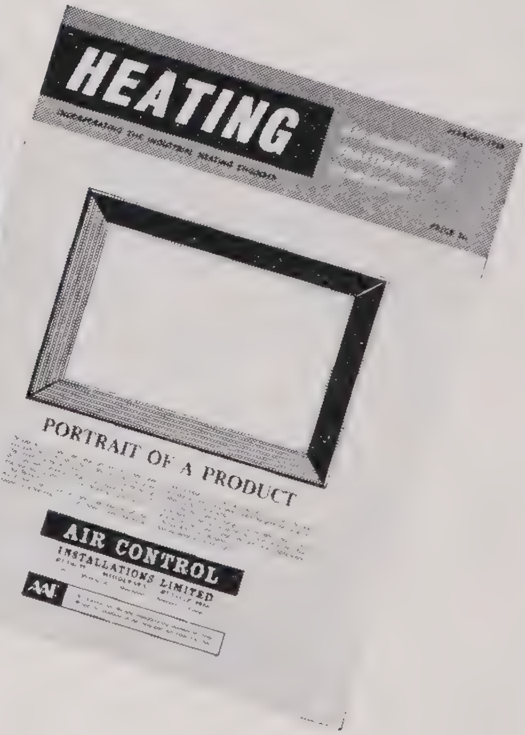

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SMOKELESS AIR

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SMOKELESS AIR is the official organ of the Society, but the views expressed in contributed articles are not necessarily endorsed by the Society. Abstraction and quotation of matter are permitted, except where stated, provided that due acknowledgments, including the name and address of the Society, are made.

Ships, towers, domes, theatres and temples lie
Open unto the fields, and to the sky;
All bright and glittering in the smokeless air.

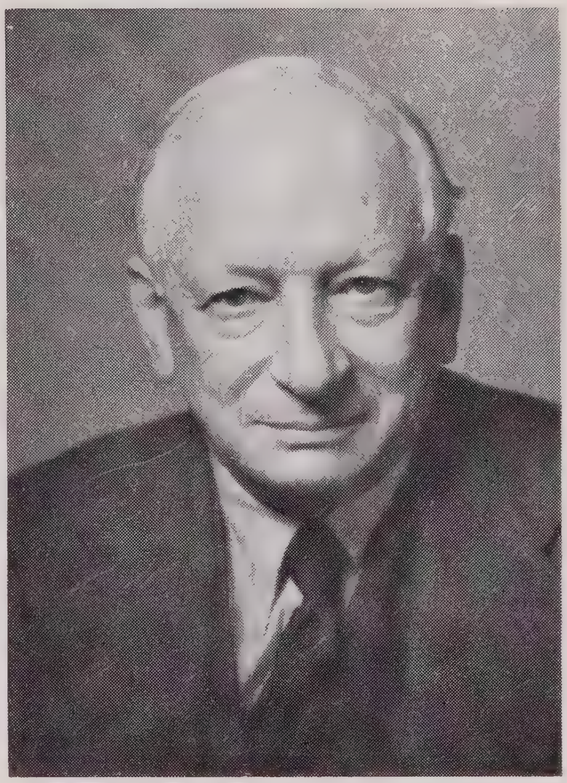
SMOKELESS AIR

The Society

THE scope of this journal is much wider than the affairs of the Society which publishes it, and its readership is far from being confined to the Society's members. Nevertheless, it is difficult not to begin these notes other than by discussing the Society and what it is doing. Its recent conference at Llandudno appears to be regarded by those who attended as one of the most useful and interesting ever held. The attendance was certainly the highest—787, as compared with the previous record, last year, of 717. The Exhibition organized in conjunction with the conference was an experiment that turned out to be more successful than we had ventured to hope—successful in that it was welcomed by the members and delegates, and that it pleased the exhibitors, many of whom are already inquiring about space at the International Conference next year.

Although the *Proceedings* of the conference, now in course of preparation, will include all the addresses, papers and discussions, we are reprinting in this issue two of the most outstanding—the encouraging address by the Minister of Housing and Local Government, and the fine Des Voeux Memorial Lecture by Sir William Holford. We ask those who were present at the conference, and who will be able to read these in the *Proceedings*, to bear in mind that six out of every seven readers of this journal will not receive that volume.

The attention of the Council and its Conference Committee, is now being turned to the preparations for the Diamond Jubilee conference in London next October, about which more information is given on another page.



Sir Hugh Beaver, K.B.E., LL.D.

The Officers

Members and representatives were aware that Sir Hugh Beaver had agreed to allow his name to go forward for nomination as the new President to succeed Dr. Lessing, whose two-year term of office ended in October. There was no other nomination and the election of Sir Hugh was announced at the Annual General Meeting in Llandudno, amid warm applause. It is quite unnecessary to introduce Sir Hugh, whose inspiring chairmanship of the Committee on Air Pollution did so much to make possible the Clean Air Act. He is at present so fully occupied—the Presidency of the Federation of British Industries being only one of his many extra-business responsibilities—that we are especially grateful to him for his present help.

Nominations for the new office of Senior Vice-President are made by the Executive Council, and it is gratifying to record that their invitation to Sir Graham Sutton, F.R.S., to be the first holder of the office, has been accepted. Sir Graham, who is Director-General of the Meteorological Office, was the distinguished author of the 1957 Des Voeux Memorial Lecture at Hastings, on " Air Pollution and Meteorology." That lecture pointed out the common ground shared by the two subjects, and led to the recent successful joint meeting with the Royal Meteorological Society.

The only nomination for Honorary Treasurer was Mr. S. E. Cohen, who had been elected as Acting Hon. Treasurer by the Council after the resignation, because of ill-health of Sir Ernest Smith. Mr. Cohen, who was therefore declared elected, is a member of the Court of Common Council of the City of London.

At the first meeting of the newly-elected Executive Council to be held after the A.G.M., Dr. J. S. G. Burnett was re-elected as Chairman, and Mr. John Innes and Dr. J. L. Burn as Deputy Chairmen.

The Committee organization of the Council has been modified and extended, and there are now the following Committees: General Purposes and Finance, Conference, Technical, Publicity, and Parliamentary and Local Government.

The Subscription Rates

The Annual General Meeting at Llandudno adopted, without dissent or amendment, the resolution submitted on behalf of the Council to raise the minimum subscription rates for Local Authority and Corporate Members. Those affected have been informed of the changes, which take effect when a member's subscription next becomes due. There are naturally some fears when changes of this kind are made that there may be some loss of membership, but we sincerely hope that the need for the increases will be recognized and accepted. With the Society it is not simply a case of more income needed to meet the increased costs that have to be borne even by organizations that are not developing, but—as the article in our last issue tried to show—it is also to enable the Society to cope with its growing obligations, accentuated as they have been by the coming of the Clean Air Act.

One new instance of the way in which costs creep—or rather jump—up on us is that, although more office (and storage) space is urgently needed, but cannot be afforded, we learn that we shall soon have to face a substantially increased rent. The accounts for the year ended on June 30th last, submitted to the A.G.M., show a serious deficit, not because of any loss of membership, but because of unavoidable outgoings. It is hoped that the situation is understood by any members who may be hesitating over the few additional guineas we ask of them.

Comments on the Act

The administration of the Clean Air Act seems to be being achieved smoothly and successfully. The smoke control area proposals are rapidly increasing in number, and control through the industrial sections does not appear to be causing any considerable difficulties. Elsewhere we report some of the first prosecutions to be taken under the Act. That there have been very few must not be taken as a sign of slackness, but rather of recognition that the best way of making the Act succeed is to prosecute only in the last resort.

Two criticisms of the way the Act is working have been heard. The first is on the meaning (in Section 5) of the words " shall use any practicable means there may be for minimizing the emission of grit and dust." To minimize means to reduce to the minimum that is possible, and " practicable " is defined in the Act as meaning " reasonably practicable, having regard amongst other things, to local conditions and circumstances, to the financial implications and to the current state of technical knowledge," while " practicable means " means also taking into account " the provision and maintenance of plant and the proper use thereof." The argument—which was forcefully put at a recent meeting of combustion technologists in industry—was to the effect that as all these factors had to be taken into consideration, and all were open to varying interpretations, there was a wide area of uncertainty on where what may be called " reasonable minimization " begins, or ends. What would be preferred is some kind of standard, or limit, of emission, so that those concerned may know more exactly where they stand and what they have to do.

The other criticism comes mainly, we find, from the coal trade, and was in fact voiced by Mr. J. V. Froom, Chairman of the Society of Coal Merchants, at a recent meeting of the Society's South-East Division. It is that smoke control areas should be confined to the black areas, and to districts where there are co-ordinated plans for their extension. Small, isolated or token areas, dotted about the country, with no early prospects of being enlarged, are of little value and divert smokeless fuels (especially the " premium " fuels) from the black areas where they do most good. There is a good deal in this, as far as it goes, and it is certainly preferable for smoke control areas in the black areas to be given priority—the Minister at Llandudno hinted at this—but there are other facts and factors to be considered. To begin with, an examination of the list of existing and proposed smoke control areas shows that all but a very few are in, or on the fringe of, black areas, and we doubt if the ratio will change very much. Secondly, it is surely rather absurd to do anything to prevent or discourage a new town or large new housing project from making itself smokeless from the start, if it so wishes, even if this does take up some smokeless fuel that might be used in a black area. Smoke control areas and smokeless zones may well, in the future, have to be put in order of priority, because of fuel supply problems, but the effect of the relatively few schemes in the " white " or " grey " areas is likely to be only marginal. The real answer to the problem, as and when it arises (and it will be a sign of healthy progress when it does) will surely be to increase the supplies of smokeless fuel.

Rose Macaulay

All who enjoyed the graceful, witty, and often erudite contributions to English literature by Dame Rose Macaulay would be saddened to hear of her recent death. Many of our members will be familiar with the delightful preface she wrote to the edition of John Evelyn's " Fumifugium," published by the Society in 1933—a publication that, being so different from the usual propaganda tract, has proved to be a very telling form of propaganda. Perhaps simply to quote a characteristic passage from this preface is the way in which we can pay a slight tribute to its distinguished author:

> Should coal smoke ever be banished from London, and such clear light and air as Britain can manage be restored, it will then be time to consider Mr. Evelyn's further plan (and it was this, we may be sure, that he mainly had in his gardener's heart) and plant all the city with sweet and ravishing shrubs and flowers, making it fragrant with thyme, sweetbriar, rosemary, musk, and all the odiferous and blossoming trees, so that it shall smell as sweet as Genoa among her orange gardens. Then too we can paint the houses, small and great, in gay colours, which will endure in that radiant sunshine with which we so hopefully expect the gods to bless our island as a reward for clearing it of smoke. Let us, anyhow, follow Mr. Evelyn's example, and hope.

Llandudno Conference

Address by the Rt. Hon. Henry Brooke, M.P., Minister of Housing and Local Government

I AM determined to make the Government's Clean Air policy a success, and I welcome this opportunity to address the Conference of the National Society for Clean Air.

I congratulate the Society on its new title. Your title recognizes that the purpose now is not only smoke abatement, but the suppression of air pollution in all its forms.

As Minister for Welsh Affairs, too, I welcome the fact that we have all come together here in Wales. The splendid air of Llandudno is free from man-made pollution, or almost so. No one can truly say that of all parts of Wales—yet.

Your President, Dr. Lessing, this year completes half a century's association with the Society and its predecessor. His untiring work in the struggle against air pollution on behalf of the Society and in his personal capacity is legendary. We are all of us delighted that this year Her Majesty should have been pleased to appoint him a Commander of the Order of the British Empire.

The Society, of course, is drawing near its Diamond Jubilee. In 1959 it will be sixty years since the establishment of the Coal Smoke Abatement Society in London. Events in the Society's history seem to have a habit of falling in the ninth year of each decade. The Smoke Abatement League of Great Britain, concerned mainly with the provinces, was set up in 1909. The National Smoke Abatement Society was formed by the amalgamation of the two parent organizations in 1929.

I hear that the Society proposes to mark the Diamond Jubilee by holding an International Conference and Exhibition in London during October next year. It is worthy of the tradition of the old National Smoke Abatement Society that, in celebrating its Jubilee, the Society should be looking not inwards but outwards, and be concerned to share its knowledge and experience with representatives from overseas. I know there is a growing recognition of the menace of air pollution not only in the United States but in many countries within and without the Commonwealth.

As we are now the country with the most advanced system of legislative control over air pollution, our experience may be of value to others. But we have also much to learn, and we need not be ashamed of saying so. International co-operation is highly desirable in assessing the problem of air pollution and in devising remedies. Both O.E.E.C. and the World Health Organization have initiated joint studies and conferences on clean air problems. By pooling the varied experience of different countries and by sharing the techniques for mitigating smoke and fumes and dust from industrial processes which present special technical difficulties, the time taken in mastering these problems in each individual country can be greatly reduced.

The other major event of 1958, challenging in importance the Society's change of name, took place on June 1st—the "Second Appointed Day"—the day on which the Clean Air Act came fully into force. The introduction on that day of the industrial parts of the Act was accompanied by my issuing three sets of regulations.

The Dark Smoke Regulations

First, there are the dark smoke

The Minister and Platform at Llandudno

regulations. They prescribe the maximum limits for emissions of dark smoke from buildings. They set the standard of smoke emission from industrial furnaces. The time limits—basically ten minutes in eight hours—are exacting without being unduly onerous. They will be observed only where furnaces are fired efficiently, and are properly maintained and operated. The limits are related to a period of eight hours in order to correspond with normal shift working. From the point of view of local authorities who have to administer the Act, a shorter period permitting continuous observation would have been easier to enforce; but one has to take account of the normal cycle of operations in the boiler-house.

There are other important limitations in the regulations which will of course assist local authorities in enforcement—the limit of four minutes for continuous dark smoke, and the prohibition of more than two minutes black smoke in thirty minutes.

Secondly there are new regulations dealing with dark smoke from ships. They allow, for the time being, rather longer limits than those applying on land. Often the difficulties in the way of adapting ship's boilers to comply with the Act are formidable, and further work is needed to improve the smoke eliminating devices for marine boilers. This is being undertaken by the Fuel Research Station of D.S.I.R. in conjunction with the shipping industry. When it is completed and the new devices can be manufactured, we shall see whether some tightening of the regulations is practicable. But the problem of controlling smoke from ships will always be more difficult than with installations ashore, because of the varying and often exacting conditions on the water.

Scheduled Processes

The third part of the preparations for June 1st was the Order extending the Alkali Act to additional industrial processes which give rise to technical questions of difficulty and complexity in the prevention of smoke, dust and grit.

In listing the processes to be brought under the Alkali Act, we took great care to schedule only those which do present difficult or intractable problems. We were concerned not to cast the net too widely, or to deprive local authorities of control over works where they were quite competent to exercise it. The balance is probably about right, bearing in mind that the Order is of general application—it applies to all local authorities, small or large—and there is a procedure in subsection 2 of section 17 of the Clean Air Act which enables control to be transferred from my Department to individual authorities in suitable cases.

Applications for this will be considered on their merits, taking into account the experience and capacity of the local authority and the nature and problems presented by the processes over which they are seeking control. Two authorities, Sheffield and West Bromwich, have so far submitted applications; consultation is about to take place with the industrial firms who might be affected by an Order based on their proposals.

There seems to me occasionally to be some misunderstanding of the working of the Alkali Act and the effect of the new Alkali Order. Anyone familiar with the Alkali Act of 1906 will remember that it talks about a " work," such as a sulphuric acid " work." Nowadays we should probably refer to a " process," or perhaps to the plant in which the particular process is operated.

It is sometimes assumed that if certain processes have been registered under the Alkali Act, then the whole of the premises or " works " comes under the Alkali Inspector. That is not so. The Alkali Inspector deals only with the plant concerned with scheduled processes. Anything else which is not part of the scheduled process comes under the local authority and the Clean Air Act.

It is important that the processes which come under the Alkali Act and under the Clean Air Act should each be clearly known. We are proposing to inform local authorities of all the registered processes in their districts, as soon as the registration of all the works now coming under the Alkali Act is completed.

Before the 1958 Order there were some 830 premises conducting about 1,600 registered processes under that Act. Registration is not quite complete, but the latest figures available indicate that about 2,100 premises with some 3,400 processes or installations now are under the Alkali Act. This may sound a lot, but the numbers are of course quite small compared with the enormously greater number of boiler and furnace plants of all kinds which local authorities are responsible for watching under the Clean Air Act.

To deal with this increase in the work of my Alkali Inspectorate the number of Inspectors actually on the job has been increased from 10 to 20, and we are aiming ultimately at 28. With this team of men, all of them chemical technologists qualified not only academically but by their practical experience in industry, we should be well placed to attack the more intractable kinds of industrial pollution by smoke, grit and dust. We see this as a joint operation, calling for a united effort: certainly not as a battle between the Alkali Inspectors and industry, certainly not as a tug-of-war between the Inspectors and local authorities. The enemy is not one another. The enemy is air pollution. It is the common foe of us all, and we all are allies in making relentless war on it.

So you can be sure that on the industrial side we now have legislation which should prove effective in dealing with a broad range of air pollution problems. Of course we have not reached perfection. Of course we must not expect to achieve 100 per cent. clean air forthwith. Of course there are all sorts of practical difficulties ahead. But we are the first country in the world to introduce a complete system of legislation for dealing with the problem on a national basis.

If we can attain sensible and forceful and consistent administration by local and central government, and if we can get the co-operation of the man in the street and the man in the boiler-house and the woman in the home, the Act can achieve the Government's purpose and yours: and that is to reduce smoke, grit and dust in our towns and cities to a level unknown for a hundred years or more. This is my determined intent.

On the industrial side we ought to see a substantial improvement within the next five years or so. The period allowed by the Act for alterations to plant expires in the middle of 1963. During this time all the necessary improvements to furnaces and boilers will have to be carried out—the fitting of mechanical stokers, and the provision of instruments for observing and checking smoke. There ought also to be a steady growth in the fitting of dust and grit arrestors to furnaces.

In the processes which come under the Alkali Act there should also be improvements coming along by then. For instance, in the gas and electricity and pottery industries the process of shutting down older works and installations will have gone yet a stage further; and it is the older plant which so often is responsible for the most smoke.

Smoke Control Areas

Now about pollution from house chimneys. Nearly 500 local authorities have adopted the Model Byelaw requiring the installation in new buildings of domestic appliances which are capable of using smokeless fuels. Most of the authorities in the black areas have done so. This means that over a wide part of the country new houses will be equipped with the right appliances from the start, and there will be no need to spend money on converting fireplaces to burn smokeless fuels.

The development of smoke control areas is speeding up. My department has been notified of proposals for 182 smoke control areas from 108 local authorities. They relate to nearly 200,000 premises and about 33,000 acres of land. This is not bad going considering that the Clean Air Act has been in force only some twenty months. But of course it is but a start when measured by the task that lies ahead.

There are seven million houses in the " black areas," as well as hundreds of thousands of shops, offices and similar buildings. The black areas extend over 3 million acres. We have a long way to go.

The time is coming when we may need to look systematically at what local authorities propose to do in future years. But we have made a useful start; and the first Smoke Control Orders under the Act have been coming into force this year. There will be twenty-eight of these Orders in operation by Christmas.

When my colleague Lord Mills spoke to the Society at your conference in Hastings last year he stressed the importance of educating people about the evils of air pollution: informing them rather than exhorting them: presenting facts that will combat prejudice and ignorance.

Publicity

People are becoming more aware that smoke and dust and grime are a menace to health and happiness: but not everybody has yet realized that it is usually possible and quite often easy to do something about it.

This year there has been more helpful publicity in the Press on the subject of clean air than ever before—particularly at the time of the Second Appointed Day. Many good leaflets and booklets have been published about the Act and about means of complying with it. My Department has produced memoranda for local authorities, and we shall shortly be publishing a short explanatory leaflet about smoke control areas which local authorities can give to householders in those areas.

We have also produced a short television film for showing when fog warnings are broadcast. That will be available this winter if fogs threaten.

Of course your Society has long been active in clean air publicity. It is skilful and experienced in presenting the facts. I am glad that the splendid work of education carried on in the regional clean air campaigns is to continue in the West Riding. The prominent part which the Society plays in these campaigns is, in my view, of the utmost value.

The benefits to health, the avoidance of fuel wastage and economic loss, the prevention of damage to buildings and materials, the greater cleanliness and the less drudgery—these may be familiar texts, but they cannot be too often repeated.

I believe the Clean Air movement can make a still wider appeal. The clean air campaign is a movement to stir the senses, a movement which can contribute to the bettering of the very essence of town life in this land of ours.

One evil effect of the film of impurities which hangs over towns is that it reduces the light of the sky and makes the whole scene dimmer, less cheerful, less colourful. Pure air has an extra value because it sharpens outlines and intensifies colours. One gets an impression of a greater keenness of the senses when the atmosphere has been washed by rain. Our ultimate aim must be to make towns and industrial districts not only cleaner and more presentable, but more exhilarating places to be in.

I am the Minister charged with responsibility for town and country planning as well as with what are called the environmental health services—housing, water supply, sewerage, refuse disposal, clean air, and so on—and I can see, better than most, perhaps, the kinship these have with one another.

As towns become cleaner and healthier, we can think again about making them beautiful. Trees will grow more vigorously, particularly the many kinds which hate a smoky atmosphere—you will see that point made in my Ministry's little book on *Trees in Town and City* that is now being published.

Perhaps we shall need a campaign to get houses painted brightly and buildings cleaned—to give the towns a new look as the tide of smoke is driven back. Certainly architects will have to think harder about colour. As the purity of the light in the centre of big towns improves, the colour of paint will not only remain bright longer, but will appear more intense. Discriminating use of colours in brickwork, roofs and facing materials generally, as well as in paint, will become more rewarding than for years.

We shall have to study more intensively colour qualities of different local stones and other building materials, and the harmonies which can be achieved by picking out the surroundings of doors and windows in colour. One can see that growing nowadays in the mining valleys of South Wales.

You have done well to get Sir William Holford to give the Des Voeux Lecture this year. His theme—" Clean Air, Urban Amenity and the Growth of Towns"—is a reminder that the aims of the clean air campaign are not merely to remedy the blight of air pollution.

The tendency for towns to grow outward into the country, and for people to live away from the towns in which they work, is not simply due to the pressure of population or the need for more house space. I am sure it reflects a desire to escape from drabness and dimness. Let us see if the campaign for clean air can be linked with a campaign to make towns beautiful, and life the sweeter for it all.

Coke May Save You £100

The uses of coke for central heating and other boiler work in industry and commerce is described in a new brochure issued by the Gas Council, entitled " This May Save You £100." This is a reference to the fines that may be imposed for dark smoke emission under the Clean Air Act. The brochure describes, with illustrations, the various types of installation that may be used with coke, and in many cases gives a figure for the cost of conversion. It should be helpful to many owners of guilty chimneys.

Quotes from the Conference

Delicate Plant

The part played by the Society in preparing the ground for workable legislation is acknowledged on all sides. It has sown the seed but must not regard the passing of the Clean Air Act as the fruit grown from it, but rather as a delicate plant which needs assiduous tending and fertilizing to bring it to final fruition.—*Dr. Lessing*.

Dark Smoke

The control of dark smoke can be achieved if the representatives of local authorities accept the responsibilities that the full implementation of the Clean Air Act involves. The common practice of waiting for smoke nuisance complaints from the public before action is taken is over.—*George W. Farquharson* (Birmingham).

Dust and Grit

The sections of the new Act concerning dust and grit are quite specific but there is no doubt that the practical administration and implementation of the provisions of the statute will take time, much ingenuity, and not a little coercion.—*Thomas M. Ashford* (Glasgow).

Conflict

It may well be that a conflict of interests will arise between designers who are anxious to preserve the external appearance of their buildings and the officers of the local authority who may be anxious to raise the point of discharge of flue gases. There will be many cases in which a compromise has to be agreed upon to strike a balance between preserving the amenities of the district and preventing pollution of the atmosphere in the neighbourhood.—*Norman Bastable* (*Barking*).

Smoke Control Areas

When considering progress in the establishment of smoke control areas in the North-West we are immediately reminded that this is the area in which administrative control of smoke emission was first created.—*A. E. Snodgrass* (*Bury*).

So far as can be ascertained, the cities of Bristol and Exeter are the only places in the South-West which have taken active steps to establish smoke control areas.—*F. J. Redstone* (*Bristol*).

The greatest difficulty appears to be the convincing of the public of the need for smoke control, particularly in relation to the domestic use of fuel. There is the utmost need for the fullest publicity on the desirability of the use of smokeless fuels.—*J. J. Matthews* (*Acton*).

Apart from those odd local authorities which are purely residential and who consider no problem exists, there is sufficient evidence [in the North-East] to show that concessionary coal and the reluctance to have it interfered with is the stumbling block in 60 per cent. of the authorities.—*G. W. Tate* (*Ashington*).

The prospects of progress in the coal mining areas [in Yorkshire] do not seem very promising at the present time.—*James Goodfellow* (*Leeds*).

Twelve local authorities in mining areas [East Midlands] refer to the concessionary coal arrangements for miners. This appears to be a major problem in mining districts and it is suggested that no real progress will be achieved until a satisfactory national agreement on the subject has been reached.—*Alfred Wade* (*Nottingham*).

The City of London

An attempt has been made to estimate the reduction of smoke concentration in the City of London's smokeless zone. It is not possible at this stage to make a firm assessment but there are indications that the average concentration over much of the smokeless zone is about 40 per cent. below that of the adjacent boroughs.—*T. S. Pindard and Dr. E. T. Wilkins* (*D.S.I.R.*).

Lung Cancer

The general drift of the accumulating evidence seems to be that the cigarette and air pollution theories of the promotion of lung cancer are not mutually exclusive. Both agents appear to add their quota to the mounting insult to the respiratory system which eventually produces malignant change. But, of the two, cigarette smoking has, in present circumstances, in this country, the dominant effect.—*Dr. D. D. Reid* (*London School of Hygiene and Tropical Medicine*).

The Lamb Test

In the southern hemisphere, where fallout has been less than in the northern, the amount of strontium in sheep bones is also less. It can be mentioned that it was ascertained in the L.C.C. laboratory that English and New Zealand lamb could usually be differentiated by this property.—*G. B. Courtier* (*L.C.C.*).

Soot Blowing

In my opinion soot blowing is one of the worst ways of polluting the air, and in allowing longer time for dark smoke emission during soot blowing the Act is weak. Surely the proper way is to *draw* soot out of the furnace, not to blow it into the air.—*Councillor W. A. Norman Jones* (*Birmingham*).

Comparison

The task given to Alkali Inspectors is an impossible one in that only twenty will be available to cover the whole country. What would be the financial condition of the nation if there were only twenty Tax Inspectors, and what fun and profit it would be to make frequent trips to the Continent or even the Channel Islands if the Customs and Excise Service had only twenty Port Inspectors!—*Councillor C. A. Watson* (*Scunthorpe*).

Ships Under Way

The Regulations do not permit the emission of black smoke for more than 3 minutes in any period of 30 minutes, or dark smoke for more than 20 minutes in any one hour. Considering that vessels travel at some 11 knots, a vessel under observation may either pass through the length of jurisdiction, or be out of sight before the observation is complete. In other words, almost total exemption has been given to all vessels whilst under way!—*W. H. Wattleworth* (*Liverpool*).

Sulphur

My Council has protested for many years against the great and increasing amount of sulphur used in chemical manufacture in our industrial area, Trafford Park. A field near one of our main roads is covered with sulphur, of which 2 per cent. is allowed to be emitted into an atmosphere already so polluted as to be almost the worst in Great Britain. As 2 per cent. of an unlimited quantity is itself an unlimited quantity we protest that no area should be expected to suffer so grievous an infliction.—*Alderman Dr. J. Robinson* (*Stretford*).

Proud of his Authority

Conference has heard much about the problems to be met in establishing smoke control area. Delegates might find this emphasis on difficulties discouraging. In Fulham's experience difficulties proved much less formidable in practice than in theory. In my Borough, an order has become operative which affects nearly 4,000 premises, most of them Victorian houses needing new appliances or adaptations. Another 6,000 similar properties will be dealt with soon. Fulham has a ten-year programme for making the whole Borough smokeless, and progress so far justified the hope that the work will be finished in a shorter period than this. I am proud of the work that my Council has done.—*Councillor H. Rainger* (*Fulham*)

Relative Risks

While radioactive "fall-out" is news it is, nevertheless, obvious that the incidence of respiratory disease was many thousands of times greater than injury, or risk of injury, due to radioactive material. It is ludicrous—but also dangerously misleading—to hear prominent women speakers wailing about the months of agony suffered by mothers-to-be at the prospect of bearing children who would be damaged by radioactive fall-out!—*A. Houlbrooke* (*Staffs. C.C.*)

Radioactivity

It is rather startling to think that in pre-war days the total radium in the world amounted to 2,000 curies, and today the amount of radioactivity in some of the nuclear power stations would be as much as 300 to 500 million curies.—*Dr. W. J. D. Cooper* (*Central Gloucestershire United Districts*).

A Brief Survey of the Conference

THE Pier Pavilion at Llandudno was not too large for the almost eight hundred members and delegates who filled the body of the hall, nor for the exhibition held along the horse-shoe gallery above. Perhaps more delegates could have found seats, but there was certainly no room for more exhibitors—a number of requests for space had in fact to be turned down.

Compared with some conferences the attendances kept up remarkably well for all the sessions, as we have come to expect. Nevertheless the biggest was at the opening session on the Wednesday morning, when the star speaker was Mr. Henry Brooke, M.P., Minister of Housing and Local Government *and* Minister for Welsh Affairs. He was preceded by the Chairman of the Llandudno Urban District Council, Councillor Harold Neville, J.P., who welcomed the delegates in a brief but pleasing speech, and was followed by Dr. Lessing, whose retiring Presidential Address had all the admirable qualities associated with his thought and work—those of an idealist in scientist's clothing. The Minister's speech was very well received, for reasons that will be apparent from the reading of it on an adjoining page. Many were particularly grateful to the Minister for stressing so well the need for clean air for aesthetic and purely amenity reasons.

The Wednesday afternoon session on the industrial aspects of the C.A.A., with papers by Messrs. Farquharson, Ashford and Bastable, went well and gave rise to a good discussion, as did the forum on smoke control areas on the following morning, with its reports from the Divisions and a panel of experts on the platform with the authors—a broad and inviting target for the many questions that were fired at them. Thursday afternoon's speakers were notably scientific in their various fields, but they carried their learning lightly, and their papers, too, produced another good discussion. We heard Mr. Pindard and Dr. Wilkins, from the Fuel Research Station, on air pollution in and around London's smokeless zone, Dr. Reid of the London School of Hygiene and Tropical Medicine on air pollution and respiratory disease, Mr. Courtier of the L.C.C. on the hazards from airborne radioactive material, and finally Mr. Brook and Dr. Burke of B.C.U.R.A. on a new, miniature, automatic smokeless stoker for central heating.

Friday is the day for the Des Voeux Memorial Lecture, given this year by Sir William Holford. The lecture is printed elsewhere in this issue, and its content speaks for itself. But the printed word does nothing to indicate the convincing and absorbing way in which the lecture was read and heard.

Members and delegates were kept fully occupied during the evenings: on the Tuesday the popular "get together", where friends are met and people come and go as they wish; on Wednesday an exceptionally pleasant reception, by invitation of the Chairman and members of the U.D.C., with dancing, cabaret and good fellowship; and on Thursday a film show in one of the town cinemas. Here a full house saw and appreciated the new E.D.A. film "The Future is Electric", the Gas Council's film on conversions in smoke control areas, and its clever cartoon film "All Lit Up", with three fine examples of documentary film craft—not on clean air but perhaps all the more welcome for that reason—from the film library of Shell Mex and B.P. The thanks of all who saw the films were warmly expressed to those who lent them.

After the formal Annual General Meeting on the Friday morning two conference resolutions were moved, and after discussion they were both carried by a majority of those voting. The first, on behalf of the Chesterfield R.D.C., was spoken to and moved by Mr. James Law, and read as follows:

> That this Conference of the National Society for Clean Air is of the opinion that the concentrations of acid gases permitted by Sections 6 and 7 of the Alkali, etc. Works Regulations Act 1906, in the manufacture of sulphuric acid and the concentration or distillation of sulphuric acid are greatly in excess of what ought to be permitted in the present drive for cleaner air, that the discharge of acid gases within these tolerances can and does cause great discomfort and distress to persons within the area of discharge and requests the Executive Council, through the Technical Committee, to investigate the question with a view to making representations to H.M. Government.

The second, moved by Councillor Jennings for the Bolsover U.D.C., was as follows:

> That this Conference considers that as a means of giving practical encouragement to the occupiers of private dwellings to install smokeless appliances in their premises, the Minister of Housing and Local Government be requested to secure the amendment of Section 12 of the Clean Air Act, 1956, so that the grant of appropriate financial assistance is available in respect of any private dwelling irrespective of whether the premises come within a smoke control area or not, subject to the condition that where a grant is made, only those fuels authorized for use in a smoke control area shall be used for such appliances.
>
> This Conference is of the opinion that the payment of such a grant in advance of formal action would produce immediate benefits by reducing atmospheric pollution, and would also ease the financial burden on Local Authorities when formal steps are taken to declare smoke control areas.

The *Proceedings* of the Conference, containing all the addresses, papers and discussions is now in course of preparation (although somewhat delayed because of pressure of other work) and all who were registered for attending the conference will receive a copy on publication. Other members and readers may order copies at 12s. 6d. each.

Radioactivity Hazards

The November, 1958, issue of *Public Health*, the journal of the Society of Medical Officers of Health, is devoted to radioactivity. It contains seven articles on the following aspects of the problem: the need for education in radiation hazards; the nature of radiation; radiation sources and their uses; fission products and food contamination; principles of radiation measurement; the disposal of radioactive wastes; and the public health implications of a large-scale release of radioactivity.

SMOKE CONTROL AREAS

Progress Report

POSITION TO 31st OCTOBER, 1958—TOTALS

	England and Wales	Scotland
Smokeless Zones (Local Acts) in Operation *Acres*, 3,400 *Premises*, 41,060	44	1
Smoke Control Areas in Operation . . . . *Acres*, 1,255 *Premises*, 12,993	18	0
Smoke Control Area Orders—		
Confirmed	37	1
Submitted	31	1
Proposals Notified	110	5
Grand Totals	240	8

The lists given below are supplementary to the information in the last issue of *Smokeless Air* (Summer, 1958), which gave the position up to July 31st. They now show the changes and addition to October 31st. The figures for Scotland, which we are now also able to give, show the totals to date.

Some of the areas listed are new housing estates, or areas to be developed for housing. The total number of premises involved will therefore increase. An asterisk denotes that there have been objections and that a formal inquiry has been or will be held.

ENGLAND AND WALES

Smokeless Zones under Local Acts

Correction to previous list: Preston has two zones in operation, the second having an area of 126 acres and 1,184 premises.

New Smoke Control Areas in Operation

Bermondsey, Bolton No. 1 (from 1st June, 1958), Fulham No. 1, St. Marylebone No. 1, Westminster No. 1, Willenhall No. 1*, Woolwich No. 3.

New Orders Confirmed but not yet in Operation

Aireborough No. 1*, Edmonton, Hampstead, Hayes and Harlington No. 7, Holborn, Kingston-upon-Hull Nos. 1, 2 and 3, Leamington Spa, Liverpool No. 3, Newcastle-upon-Tyne, St. Marylebone No. 2, Shoreditch, Stockport, Tottenham, Wandsworth*, Willesden.

New Orders Submitted for Confirmation but not yet Confirmed

Bebington, Dewsbury No. 2, Ellesmere Port, Fulham No. 2, Hackney, Hayes and Harlington Nos. 6 and 8, Hendon, Huddersfield, Lambeth No. 1, Leicester No. 2, Oxford No. 2, Reading, Rotherham Nos. 1 to 3, Sedgeley, Sheffield, Warwick, Willenhall Nos. 2 and 5, Wood Green.

Proposals Notified to the Minister

Bethnal Green, Birmingham No. 3, Bredbury and Romily, Brentwood, Brierley Hill Nos. 1 to 9, Corby, Denton Nos. 2 and 3, Elstree and Barnet, Hammersmith, Heywood, Huddersfield No. 2, Lancaster, Liverpool Nos. 6 and 7, Manchester No. 2, Middleton, Newport, Paddington, Pontefract, Preston, Shardlow No. 3, Stoke-on-Trent Nos. 1 to 4, Wallasey Nos. 1 and 2, Wath-upon-Dearne, Willenhall No. 6, Wortley, Yiewsley and West Drayton.

SCOTLAND

Smokeless Zones under Local Acts
Edinburgh.

Smoke Control Areas in Operation
Nil.

Orders Confirmed but not yet in Operation
Edinburgh No. 1.

Orders Submitted for Confirmation but not yet Confirmed
Dumbarton No. 1.

Proposals Notified to the Secretary of State
Coatbridge, Dundee, Glasgow, Kirkcaldy Nos. 1 and 2.

C.A.A. NEWS ITEMS

1,100 Acre Area for Leeds

Leeds Corporation is to prepare a Smoke Control Area Order for 1,100 acres in the centre of the city, which it is hoped will come into force in 1960. It will be one of the biggest smoke control areas so far, and will include the main civic centre, the infirmary, University and new College of Technology. A preliminary survey of the area showed that it contains about 5,500 domestic, 3,500 commercial, 700 industrial, and nearly 1,000 other premises.

Correction—Again!

In our last issue but one we credited Dudley with having the largest smoke control area project in the West Midlands. In the last issue we said that it had been pointed out to us that this was not the case, and that the largest area so far was in Willenhall. It has now been pointed out that this is a further error, and that pride of place should be given to *Wednesfield.*

No Exemptions in Luton

Luton Council are stated to have refused to agree that furnaces of a number of industrial firms should be exempt from a smoke control area planned for the town's centre. The suggestion that these furnaces should be excluded was made by the Ministry of Housing and Local Government, but the Council have decided to adhere to their original view that all premises should be subject to the Order. The area covers 82 acres, with 424 houses and 710 commercial and industrial properties.

Sheffield and the Scheduled Processes

The *Sheffield Telegraph* has published an extract from a letter to the Sheffield and District Clean Air Committee (the statutory committee), which suggests that the Minister may accede to the request that the committee's own inspectors should have control over smoke from the metallurgical processes in the area. The quotation given is as follows:

" The Minister believes that a large and competent local authority employing public health inspectors qualified and experienced in smoke prevention and possessing the smoke certificate of the Royal Society of Health, or its equivalent, and a local authority, moreover, which has a tradition of interest and successful action in relation to air pollution problems in its district, can reasonably claim to control processes which give rise to what are essentially questions of fuel combustion."

Co-operation

The Hygiene and Cleansing Committee of West Bromwich Town Council is pleased with the co-operation received from the householders in the town's first smoke control area, the Chairman, Councillor F. G. Phillips, has told the Council. "We started on a sticky wicket", he said, "by choosing what we knew would be a difficult area but we are pleased with the co-operation our officers received."

High Cost of Smoke Control

"The Public Health Inspector is to be provided with a watch at a cost of £1 5s. for use in connection with his duties relating to smoke observations under the Clean Air Act, 1956."—*Extract from a local Newspaper.*

Fuel Efficiency Diary

The 1959 edition of the Industrial Fuel Efficiency Diary, published by H. O. Quinn, Ltd., London, is perhaps the most useful diary for anyone concerned with fuel in any of its forms, and especially for technologists in industry. It should also be very useful to smoke inspectors. Edited by H. B. Locke, it is available in three styles, at 13s. 6d., 11s. 6d. and 8s. 6d, according to binding. In addition to the conventional diary material there are over 100 pages of technical data, tables and nomographs. The Ringelmann shade charts are reproduced, and among other information of practical value is a section on coal prices, showing how the N.C.B. price structure scheme works and how the present price of any type of coal can be calculated. The format of the diary is 3½ by 5½ inches.

The railway marshalling yards at Preston are adjacent to a smokeless zone, and to overcome their smoke diesel shunting engines are being introduced. These are the first in the north-west, and at an inaugural ceremony on 15th September the Mayor of Preston, Mrs. M. A. Wignall, accompanied by the Mayoress, Mrs. E. Muir, drove the first diesel down to Preston Docks and back. (Photo by courtesy "Lancashire Evening Post".)

Clean Air Act Cases

Reports of some of the first Court cases under the Act are given below. We hope regularly to record further cases, especially where they contain points of special interest that are likely to be of value to other local authorities. Press reports are not always the best source of such information, and local authority readers are cordially invited to send in (as did Walsall in the first report below) succinct accounts of their own cases, with special reference to matters of legal importance.

C.A.A., Section 16—Emission of Smoke and Ash in such quantities as to be a nuisance to the inhabitants of the neighbourhood.

Walsall's first case under the Clean Air Act, 1956, was heard by the Borough Magistrates on Monday 22nd September. The prosecution was in respect of the emission of smoke and ash in such quantities as to be a nuisance to the inhabitants of the neighbourhood; it was not made because of contravention of the dark smoke provisions of the Act. The nuisance was due to burning of scrap cable on an improvised grate in the open yard of a factory.

The case for the Corporation was presented by their Senior Assistant Solicitor Mr. B. F. Dale; Mr. F. Blennerhasset represented the defendants, Midland Smelters Ltd., of Fryers Road, Bloxwich, Walsall.

The firm had previously been given both verbal and written notice of the nuisance caused by this practice and had themselves given to the Corporation's officers verbal and written undertakings that the practice of burning cable in the open air would be discontinued. The Corporation had not served statutory notices for these offences but were seeking from the Court an Order under section 16 (2) of the Clean Air Act, 1956, prohibiting the recurrence of a nuisance, which, though abated, was likely to recur. The particular contraventions took place on Thursday and Friday the 26th and 27th June, 1958; the nuisance on the first day was the subject of complaint by a resident: that on the second day was observed by the Health Department's Smoke Abatement Officer, Mr. S. Monks.

In accordance with the provisions of section 30 of the Act written notice that a nuisance to which section 16 of the Act applies had taken place was delivered to the registered offices of the Company within 48 hours of the officer having become aware of the contraventions of the Act.

On behalf of the firm Mr. Blennerhasset admitted the offences complained of and expressed regret. In extenuation he pointed out that the present manager of the works had taken over control in 1956 but had, unfortunately, never been informed of the undertakings given to the Corporation that cable would not be burnt in the open air. He said that the manager was annoyed about these incidents and had since taken steps to prevent a recurrence of them. Continuing, Mr. Blennerhasset said that the person responsible for these incidents had been questioned and had stated that he set fire to the cable on these two occasions because the wind was blowing away from the nearby houses. In conclusion he asked the court, in view of the express undertakings given by the defendant firm that there would be no repetition of the nuisance, not to make the Order asked for by the Corporation.

For the Corporation Mr. Dale contended that the case was one which should be dealt with by the making of an Order under section 16 of the Act.

After considering the matter the Magistrates made an Order in the following terms and awarded

£3 11s. 6d. costs:

> " The said Midland Smelters Ltd., shall forthwith discontinue the burning of any cable or other material, except in the furnaces at the premises, so as to constitute a nuisance ".

Section 1—Black Smoke from Laundry

The first case of its kind to come before the Sheffield magistrates was in respect of black smoke, under section 1 of the Clean Air Act. It was stated that the offence occurred nine days after the Act came into force.

The Abbey Glen Laundry, Sheffield, were fined £10 after admitting allowing the emission of black smoke for a continuous period of 12 minutes in a 30-minutes period. Prosecuting, Mr. George W. T. Pitt said that under Section 1 of the Act dark smoke should not be emitted from any chimney. An inspector had seen black smoke being emitted from the laundry chimney between 3.30 p.m. and 4 p.m. continuously for 12 minutes. The fires were being cleaned out, but there was not sufficient care being taken to prevent the emission of smoke.

Mr. Thornton Lambert, for the laundry, said that just prior to this occurrence, they had received coal from the National Coal Board which was " manifestly unsuitable ". It made a great deal of clinker and it was therefore necessary to clean out the fires far more often than was usual.

Sections 1 and 3—Bradford

Bradford's first prosecutions under the C.A.A. have been authorized by the Health Committee, subject to the Town Clerk being satisfied on the question of evidence. The Committee authorized proceedings against two Bradford firms, one under section 3, and the second under section 1.

Section 1—Black Smoke from Colliery

On 29th September Denton and Best Ltd., of Livesey Street, Sheffield, before the Sheffield magistrates, pleaded guilty to a summons complaining that black smoke was emitted for an aggregate of nine minutes from a chimney at Birley Meadow steel works, during a half hour period of observation on 16th June.

Mr. J. Neilson, for the defendants, said it was accepted that there was no defence; the offence was caused by the use of coal of an inferior type. He announced that the firm had decided to convert to oil firing, and commented " Perhaps that was one of the ideas behind the Act."

Interim safety devices included a smoke density alarm, which was then being assembled and would be working during the week.

A fine of £10 was imposed.

Section 20—Smoke from Ship

According to a *Daily Telegraph* report the Port and City of London Health Committee has decided to prosecute under the Clean Air Act in the case of a ship alleged to have emitted black smoke in the Port of London in excess of the permitted period. It is believed that this is the first case of action being taken under Section 20 of the Act.

Year Book of the Heating and Ventilating Industry.—We have received a copy of the new edition of this useful and substantial Year Book, issued in collaboration with the Association of Heating, Ventilating and Domestic Engineering Employers by Technitrade Journals Ltd., Carlisle House, 8 Southampton Row, London, W.C.1. In addition to information about the trade, the Year Book contains much technical information, special articles including one on ventilation problems associated with the use of radioactive substances. There is a bibliography of recent literature (including a section on air pollution) and a list of relevant British Standards.

THE DIAMOND JUBILEE CONFERENCE

The arrangements for the Society's International Diamond Jubilee Conference and Exhibition in London next October are now actively in progress. On the social side it is gratifying to be able to announce that the Conference will be honoured by a reception at Guildhall, by the Rt. Hon. the Lord Mayor and the Corporation of the City of London.

Invitations are now being sent out to overseas government departments, organizations and individuals. Appreciation must be expressed for the helpful advice and assistance in this that is being given to the Society by departments of H.M. Government.

The programme being arranged is designed to be both of international interest and yet equally interesting and useful to our own members and the delegates from this country who attend our normal conferences. The opening session, on the morning of Tuesday, October 20th, will include a Presidential Address by Sir Hugh Beaver and other features yet to be arranged. The subjects for the five following sessions, on Tuesday afternoon, Wednesday and Thursday mornings, and afternoons, are provisionally as follows:

Legislation.—The principles and form of legislation in use throughout the world; organization and administration of the law; the cost of control administration, etc.

Public Opinion and Education.—Action throughout the world to secure public understanding and acceptance of control measures and methods; responsibilities and activities of governments, municipalities and voluntary associations.

Technical.—Papers and reports on air pollution problems of international concern, *e.g.*, airborne radioactive material, pollution from road vehicles, pollution from fumes and gases as distinct from smoke and grit or dust.

The Diamond Jubilee Emblem

International Co-operation; Studies and Information Exchange.—Means for the dissemination and exchange of scientific, technical and administrative information; publications, abstracts, etc., as they now exist and could be developed.

Research and Investigations.—Reports on work in progress and work required; whether and to what extent further international co-operation and the development of joint projects are desirable.

Short written contributions from Overseas (and British) delegates are being invited (or even contributions from any who may not be able to attend in person). These will be printed and distributed in advance, and will be reviewed at the appropriate session by a Rapporteur, and then discussed.

Friday will be devoted to a choice of visits or tours of clean air interest—or for Overseas delegates of more general interest.

The conference will be a day and a half longer than our usual annual conferences and organizational expenses will be considerably heavier. For this occasion therefore a conference registration fee of £4 will be made. This will include preprints of the written contributions, but a further £1 will be charged for the subsequent volume of *Proceedings*.

MINISTRY OF HEALTH AND AIR POLLUTION

More Research is Needed

Report of the Ministry of Health for the Year 1957: Part II (Cmd.559) H.M.S.O., 13s.

Sir John Charles, Chief Medical Officer of the Ministry of Health, gives much attention to air pollution in his review of the nation's health for 1957. While the first step, he writes, is to deal with such visible pollution as smoke, grit and dust, the even more harmful gaseous pollutants present a problem which will tax the resources of all engaged in the present campaign.

Sir John suggests that so far as health departments are concerned, studies might be organized in co-operation with university departments to ascertain the relation between recorded measurements of air pollution and the incidence of chronic bronchitis, acute respiratory disease and lung cancer.

A longer term inquiry, he suggests, is the making of surveys into the health of people living in smoke control areas. Team work and co-operation between local authorities would be required in tackling the problem as well as between Government departments, university, scientific, and medical workers and the Medical Research Council itself.

The December, 1957 London Smog

Discussing the dense fog which occurred in the lower Thames Valley early in December, 1957, Sir John states that 300 deaths were attributable to it in the administrative county of London, and probably over 1,000 in the Greater London area. These estimates excluded the 87 deaths in the Lewisham train disaster, which it is said might be regarded as an indirect result.

This fog was the fourth in Greater London during the past 10 years to be associated with a heavy increase in mortality. During the period 2nd December to 5th December, 1957, atmospheric pollution appears to have been heaviest in the eastern part of the Greater London area and it was here that the highest mortality occurred. In Barking, Chigwell, Dagenham, East Ham, Hornsey, Ilford, Leyton, Wanstead, Woodford, and West Ham, the ratio of deaths during the week of the fog to the number in the preceding week was 1·42:1.

Deaths began to show an upward trend on the first day of the fog before the atmospheric pollution had reached its maximum, and the number of deaths continued to rise until 5th December, the last day of the fog. After that there was an abrupt fall. An early increase in the cases of acute illness requiring urgent admission to hospital had also been noted.

Recently the daily numbers of deaths in the metropolitan boroughs had been used in the investigation of a number of London fogs during the years 1954-56, and in a comparative study of the January, 1956, and December, 1957, fogs. The investigators had suggested that in London there was a critical level of four times the customary winter average of atmospheric pollution above which a fog would cause a marked immediate excess mortality. This observation coupled with the increase in mortality noted on the first day of the fogs of 1952, 1956, and 1957, pointed to the toll which might be exacted by many fogs of shorter duration when the number of deaths would not be obvious in mortality statistics.

London "Clear the Air" Exhibition

Speech by Lord Mills

Under the auspices of the Royal Society of Health, and with the co-operation of other interested organizations, a "Clear the Air" Exhibition was held in London during the first part of November. The bodies participating were the National Society for Clean Air, the Department of Scientific and Industrial Research, the Combustion Engineering Association, Central Council for Health Education, Electrical Development Association, Gas Council and Solid Smokeless Fuels Federation.

The Exhibition was opened on 3rd November by the Minister of Power, the Rt. Hon. Lord Mills. His speech was as follows:

THE United Kingdom is the first country in the world to introduce by legislation a comprehensive system for dealing with a serious clean air problem.

The progress so far made is encouraging. Already 29 smoke control areas have been brought into operation, and there are a further 152 proposals for smoke control areas which have been submitted to the Government for consideration.

I think this shows that many local authorities are taking the initiative which the Act offers to them. In doing this, they are receiving strong support from their local residents, for I believe that people are becoming increasingly aware that smoke is more than just a nuisance—it is a menace to health and happiness which should no longer be tolerated.

Action is most needed in the so-called "black areas" whose pall of dark smoke is the cause of dust, dirt and discomfort, and a symbol of wasted fuel and wasted money. But I fear that the majority of local authorities in the black areas have not yet come forward with clean air proposals. I would urge them most strongly to act now.

My main concern, as the Minister responsible for fuel and power, is to see that the smokeless fuels necessary to make the Act effective are available when required.

I think it is worth noting that the use of smokeless fuels is already a well-established trend. There has, in recent years, been a marked tendency for coal to be used more and more in its smokeless forms—as electricity, gas and coke, as well as prepared smokeless fuels. Since 1948, coke consumption has increased by 15 per cent., that of gas by 27 per cent., whilst the consumption of electricity has doubled. Whereas before the war, these smokeless fuels accounted for only a quarter of the total fuel consumption in this country, they now account for 40 per cent. or more.

This use of fuel and power in its refined forms will continue to grow and will be accelerated, of course, as the drive for cleaner air progresses.

To ensure that smokeless fuels are available for the particular smoke control areas proposed by local authorities, the Government have the advantage of advice from special committees, both in London and in the various parts of the country. I am happy to say that in no case so far have we had any difficulty in foreseeing adequate supplies of smokeless fuels to meet the needs of clean air, and I would like to thank all those who serve on these committees for

Lord Mills inspects the Society's new working model at the Royal Society of Health's " Clear the Air " Exhibition. Nearer to the camera on the right, is Lord Cohen, R.S.H. President, and on the left is Dr. R. Lessing, N.S.C.A. Immediate Past-President

the assistance they are giving us in this matter.

I should also like to pay tribute to those who produce smokeless fuels. I think sometimes we tend to take too much for granted as regards readily available supplies of smokeless fuels and power. It is so easy to press down an electric switch, or turn on a gas tap. But behind these switches and taps lie tremendous organizations employing a considerable number of people and a large share of the country's capital resources. This applies also, of course, to the production of solid smokeless fuels and to the supply and refining of oil.

I have a particular interest in the link between clean air and the efficient use of fuel, for to promote the one is to promote the other. For some fifteen years from the outbreak of war, we were in constant difficulty in trying to secure enough fuel to meet the country's rising needs, and during this period the need for the more efficient use of fuel was quite obvious.

In the last two or three years the pressure on our fuel resources has eased. But in case some people think this means that there is now less need for fuel efficiency, I would like to make it clear that this is not so. And it is not so for three reasons.

It is the Government's confident expectation that the national production will soon resume its upward trend and, as a result, more fuel of all kinds will be required.

Secondly, to produce fuel costs much in labour and capital, and to waste it is plain folly.

Thirdly, and from your point of view the most important reason is, that greater fuel efficiency is one of the keys to clean air.

I can say without hesitation, that we must continue to strive for greater efficiency in the use of fuel. The Annual Report of the National

Industrial Fuel Efficiency Service has shown that although industry is alive to the need for making better use of the nation's fuel resources there is still great scope for improvement. It is estimated that savings of between 7 and 10 million tons of coal equivalent a year can be achieved by industry mainly by the improved operation of existing plant.

Many research organizations, professional institutes and the technical departments of industrial firms have for some years been engaged on studies of fuels and their combustion. This work is vital to the proper use of fuel and to the development of smoke control areas.

It is also essential to see that the right sort of appliances are available to enable smokeless fuels to be used properly in these areas, and a large range of appliances is now produced which complies with the relevant provisions of the Clean Air Act. Visitors to the Exhibition will be able to see for themselves many of these new appliances and the techniques that are available for burning fuel more efficiently and also smokelessly.

This is the second exhibition on clean air which has been sponsored by the Royal Society of Health. In extending my warm congratulations to the Society and to all of the participating bodies, I would like to wish them every success, and to express my own hope that they will continue in this way to keep the need for clean air and fuel efficiency before people's minds.

SAVING FUEL IN INDUSTRY

NIFES Survey

Once again, in its Fourth Progress Survey (with report and accounts) the National Industrial Fuel Efficiency Service records the excellent work it is doing and convincingly shows how much more needs to be done. Its survey of the situation contains much of importance to all who are concerned with the working of the industrial sections of the Clean Air Act. Thus the wastage of fuel in boiler plant, which was emphasized in the previous survey, is further analysed from boilers that have been tested, and by means of coloured charts special attention is drawn on this occasion to the efficiencies of economic and vertical boilers. The average efficiency of 201 economic boilers tested was 69·3 per cent. compared with a " reasonable " target figure of 78 per cent. These boilers were using 200,000 tons of coal a year and between them could have saved 22,000 tons. On the average they were wasting £500 a year each.

Vertical boilers not properly attended to, says the survey, are likely to create serious offences under the Clean Air Act. When adequate supervision cannot readily be given, the remedy may lie in mechanized firing or automatic control. The cross-tube vertical boiler supplies low steam requirements in the range of 100 to 1,500 lbs. per hour, and " needs little attention, but generally receives less." High efficiencies cannot be expected, but 60 per cent. should be attainable, as against the 49·5 per cent. average of the forty-four boilers tested. The vertical smoke-tube boiler, for loads of 500 to 10,000 lbs. of steam per hour, is more effective, and is given a target efficiency of 72 per cent. The average for 144 tested was only 59 per cent.

Over 500 heat and power surveys were carried out by NIFES engineers during the year. They covered works with a fuel consumption of over 1,400,000 tons per annum of coal or its equivalent in other fuels, and pointed the way to savings of over 230,000 tons of fuel. It is estimated that the value to industry of these savings is at least £25 per annum for every £1 paid to NIFES in fees.

The mean saving was 21·5 per cent., and it is interesting to note that the greatest savings shown are from the smaller works—in particular those with an annual fuel consumption of under 2,000 tons. The smallest percentage savings were found in works with 50,000 tons or more consumption per annum.

"It has been possible," says the survey, "to collect information on the fate of 347 recommendations made in eighty-seven surveys. Analysis shows that 75 per cent. of the recommendations have been accepted and the work has been put in hand. A further 3 per cent. were alternatives to recommendations which have been accepted. Of the remainder, action on 9 per cent. has been deferred until conditions are more favourable. Only 13 per cent. have been rejected, and these decisions are not necessarily final. It is already known that some recommendations, which were rejected originally, are now being reconsidered.

The main reason for not carrying out recommendations appears to be that capital was not available. A section on the capital cost of fuel saving shows that, on the average, the cost of programmes will, at the present cost of coal, pay for itself within two years. The effects of the Government Loan Scheme for fuel-saving equipment are examined. For the year ended 31st March, 1958, 124 loans were approved, totalling £715,001, and giving a coal saving of 60,021 tons of coal per annum. Included in the figures are thirty-six schemes for mechanical stokers, giving savings of 5,370 tons, twenty-five for replacement and modification of boiler plant (9,201 tons), fifteen for economizers and other heat recovery plant (21,654 tons), and fifteen for kilns and furnaces (12,480 tons).

Large Coal and Small

The belief that it is more difficult to burn small coal efficiently—and therefore smokelessly—dies hard. The present coal surplus is essentially one of small coal and special attention is given in the survey to the use of the scarcer large coal in industry. "Some works," it says, "cling to large coal or doubles; sizes of which the National Coal Board is short. Even among firms which have switched to small fuel, there is a conviction that the combustion efficiency of their plants has suffered in consequence. Now that the N.C.B. has greatly increased the difference in price between industrial large and small coal, these are issues of considerable interest, economically and technically."

The effects of coal size on efficiency have been examined from information contained in NIFES survey reports on 555 Lancashire and 117 Economic boilers. The results are presented in tables and figures, from which some of the main conclusions drawn are:

1. The change to the smaller coals has proceeded much further than is generally imagined. Only 3 per cent. of the coal used on these boilers was large, and under 11 per cent. was doubles.
2. In the aggregate these tonnages are nevertheless substantial, and yet combustion efficiency does not suffer, generally, when the singles or smalls are used instead. Hence, the cost of using large coal or doubles, at present prices, is substantially higher than that of using singles or smalls.
3. The financial disadvantage of burning large coal and doubles would be more marked if they were used on boilers which were heavily loaded.
4. The substantial improvement in efficiency to be obtained by fitting mechanical stokers, even before the boiler plants have been brought up to standard, is clearly brought out.

The accounts of the NIFES organization are given in the report and show an income for the year of £526,817, which includes £410,229 from contributions (half from the National Coal Board) and £116,132 from fees and charges.

Late News—Orders have now been made by the Secretary of State under which the Dark Smoke and other industrial provisions of the Clean Air Act will come into operation in Scotland on 1st January, 1959.

"The Medical Officer"

Golden Jubilee

Warm congratulations to the *Medical Officer*, both on celebrating its Golden Jubilee and on the issue (for 5th September, 1958) with which it celebrated the occasion. The N.S.C.A. and its forebears owe much to this journal for its constant interest in smoke prevention, and in the work and struggles of the Society. That means, of course, that it owes much to its founder and editor, Sir George Elliston. In the Golden Jubilee number a fitting tribute to Sir George is made by Sir Allen Daley, and most interesting is the fact, referred to in another article, that the very first issue contained a report on an address by Dr. Des Voeux, with an editorial comment that is quoted as follows:

" Dr. Des Voeux . . . showed conclusively that the trouble is not wholly, or even chiefly, the factory chimney. On the contrary . . . he made it plain that the kitchen range and the open domestic grate are the real culprits. . . . It would be too much to expect the conservative British public to abandon the open grate, which is so pleasant a feature of home life in this country, but it should not be difficult to convince those who build our houses that a preventive (*sic*) nuisance cannot be allowed to continue indefinitely."

Sir George was President of the Society (and what a grand President!) from 1946 to 1948, and his interest in our work continued until his death in 1954. It is good that, with his son as its present editor, the *Medical Officer* continues to thrive and to advocate (among other things!) clean air. We wish it long life and prosperity.

AIR POLLUTION CAN CAUSE ELECTRICITY BREAKDOWNS

Dr. D. S. M'Ilhagger, Senior Lecturer in electrical engineering at Queen's University, told the members of the Institution of Electrical Engineers, Northern Ireland Centre, at a meeting in the University, that failures in the supply of electricity were often caused by the breakdown of insulators contaminated by atmospheric pollution, and that if the public could be made more electrically-minded, many of the sources of pollution would be automatically eliminated.

Dr. M'Ilhagger, who was giving his inaugural address as chairman revealed something of research work being carried out at the University in connection with high voltage transmission line insulators.

Speaking of air pollution and its effect on overhead transmission line insulators, Dr. M'Ilhagger said that a very useful approach to the problem would be to tackle contamination at the source; that was to investigate the causes of atmospheric pollution and to seek, by education and legislation, to put a stop to them where it was humanly possible, and not just economically feasible.

There was a growing public awareness that atmospheric pollution was a social evil and it was their responsibility, as electrical engineers, to foster and nurture that awareness. The very insulators which they wished to protect from atmospheric pollution carried the power lines which could enable that pollution to be abolished.—*Belfast News-Letter, 16th Oct., 1958.*

Liquefied Petroleum Gases

These gases have been in use for many years in bottled form, and are familiar to everyone. Large scale installations for using these liquefied gases began only a few years ago. One such plant, for instance, had for some years been providing the daily gas supply for a small town in South Wales, and there are now a number of other installations in use by Gas Boards, for glass annealing, at a number of motor works, and for space heating. These have been installed by W. C. Holmes & Co. Ltd., of Turnbridge, Huddersfield, who have just published an interesting illustrated brochure on the advantages, design and applications of such installations.

“ The Future is Electric ”

A NEW FILM

This new film of the Electrical Development Association was among those shown at the Llandudno Conference of the Society. In its story, photography and colour it is excellently done. It shows how the coming of nuclear power, by giving more abundant and cheaper electricity, will play a major part in the final ending of the smoke problem. The film has some first-class sequences on smoke and the squalor it creates, and the long-distance shots of smoky towns are all the more impressive because of their colour—or rather because of the subdued and dreary colour that they reveal.

The film shows what has to be done to implement the Clean Air Act, and with a fairness that must be commended it depicts some of the alternatives to electricity. Emphasis is naturally laid on what electricity is doing, and can do, in domestic and industrial heating, power production, railway modernization, and so on. Especially interesting are the parts that illustrate the newer electrical heating methods and those making use of off-peak power. This is of direct clean air interest, even though some of the further details of electrical appliances —such as hair driers and egg whisks—may be less pertinent.

The shots of power stations, including the new nuclear stations, are fascinating, and the Eastman colour in which the film is made adds to the

A striking shot from the film—the Wedgwood electric pottery at Barlaston, with a statue of Sir John Wedgwood in the foreground

A scene from the film, which needs no explanation

dramatic impressions given by the camera. Altogether it is a film to be recommended for use in any clean air campaign, and if any local authority should hesitate about showing a film devoted to one particular interest, this can be overcome by including in the programme films with other points of view. It runs for 28 minutes, and is available on free loan, in either 16 or 35 mm. sizes, from the Electrical Development Association at 2 Savoy Hill, London, W.C.2.

CLEAN AIR DISCUSSED AT AYR

At the annual congress of the Royal Sanitary Association of Scotland at Ayr in September, a paper on "Clearing the Air" was read by Mr. John Innes, Chief Sanitary Inspector, Paisley and Deputy Chairman, N.S.C.A. and President of its Scottish Division. Mr. Innes described air pollution as "the outstanding dragon in the public health field". Every time he saw what smoke did to stonework he wondered what it was doing to his lungs.

In this country, he continued, the death rate from chronic bronchitis was 34 times that recorded in the United States. On Clydeside the death rate from bronchitis was much greater than the rest of Scotland.

Mr. Innes described the innovations of the Clean Air Act as realistic and practical. They took notice for the first time of the contribution made by domestic smoke to air pollution.

Persistent education of the public—particularly of the housewife—was needed if smoke control areas were to be successful. He suggested that it should be an offence to retail or deliver other than smokeless fuel in a controlled or smoke free area.

SMOKE CONTROL AREAS

Creation, Preparation and Administration

Two papers under the above heading were given at a Midland Centre Meeting of the Association of Public Health Inspectors, on October 30th.

The first paper, on Municipal Areas, was given by Mr. B. R. Beaumont of Dudley. Mr. Beaumont described the preparations leading up to the establishment of Dudley's first Smoke Control Area. He said that the Corporation and the Public Health Department were anxious to avoid any confusion, and took steps to prevent any incongruities from arising, so as to assist the future tenants in every way, to become familiar with their appliances, and with the fuels which they could consume on them. With this end in view, all the instruction leaflets relating to the appliances fitted were collected and amended before distribution, so as to apply to the burning of smokeless fuels only, all references to bituminous coal being struck out. Arrangements were made for the collection of certain components not required for the burning of smokeless fuels.

Fuel merchants, who had left printed cards advertising their fuels, were interviewed and asked to amend the cards, so as to conform to the list of authorised fuels.

When the first new house was completed it was used as a demonstration house for a week, demonstrations being given to each caller of the operation of coke fires. This was a great success, a large attendance averaged over 100 per day, with well over 300 on the Saturday.

Mr. Beaumont said that the means by which the end had been achieved had been expressed not as a model, but as a sincere approach to an important problem, with little experience to draw from, and with no form of standard practice to be followed.

Mr. Siggers of Dudley spoke of the introduction of a Smoke Control Area in an area of privately owned houses. He said that while the task of establishing a Smoke Control Area in a new estate, either private or municipal, was essentially an administrative one, the problem in an already established area was primarily a financial one. In the already established area the Local Authority was faced with the expenditure of a sum of money on each house with no immediate advantage to be gained. Likewise, the private owner, who for years has been content in his way of life, was faced suddenly with an enforced change in his habits and the finding of his 30 per cent. of the cost of adaptation. No one was opposed to the principle of a Smoke Control Area but the universal question echoed from tenant through the Local Authority to the Ministry was, " How much will it cost ? "

Turning to the actual administration involved, Mr. Siggers said that a preliminary letter was sent out to all occupiers before they were visited by an official from the Public Health Department, partly in order to prepare the occupiers for his visit, and partly to cut down the number of questions he would be asked. In the proposed Dudley Castle Smoke Control Area the estimated cost of adaptation worked out at £30 per house for a private house and £33 for Council property. This estimate later proved fairly accurate, a quotation of £32 being received for work which the Council had estimated would cost £36.

Speaking of the detailed survey, Mr. Siggers said that the reception given to the Inspector had varied considerably. Many were enthusiastic about the plan whilst others were opposed to it mainly on grounds of cost. Others while being in favour of the establishment of Smoke Control Areas, could not see why their particular area had been chosen. There was, at present, no conception by the ordinary public of a "Smoke Controlled Country" and the general attitude was that a house was either lucky or unlucky, depending upon the prevailing attitude, in being in an area. In all cases an endeavour had been made to convince people of the necessity of Smoke Control Areas and of the benefits that could be expected from their establishment. It was of particular importance that the Inspector should be as helpful as possible as, in many cases, it would be the first occasion on which the householder had had direct contact with a Council official.

HEATING OF MULTI-STOREY FLATS

Speaking at the Annual Staff Conference of East Midlands Gas Board on October 24th, Dr. W. Davidson, Head of the Warm Air Division, Radiation Group Sales Ltd., described his company's Ductair system of warm air gas heating, and its application to multi-storey flats.

Dr. Davidson outlined the advantages which he claimed for an installation including a Ductair 20 type unit combined with water heating by a C.70 New World Gas Circulyn heater. The advantages were, he said:

1. Capital Cost; Moderate—the cost of a Ductair 20 with a C.70 Circulator (with balanced flue) plus 25-gallon lagged storage cylinder, header tank and plumbing connections between these components plus ducting, registers and grilles was £165-£180 according to layout. (Noting that special quantity prices were quoted to Local Authorities).

2. Operating Costs: Low—varying between 10s. and 15s. per week according to gas tariff.

3. Comfort Standard: High.

The system was flexible and easily controlled by thermostat to give the desired temperature in living-room and background heating to the rest of the flat as and when required. This led to economy particularly where a flat was unoccupied during the day.

4. Other Advantages:

The system gave the additional advantages associated with Ductair Heating:

(i) Uniform temperature distribution.
(ii) No need for topping-up in living-room.
(iii) Freedom from discoloration of decorations.
(iv) Air movement gave sense of freshness and freedom from stuffiness.
(v) Air movement increased comfort and reduced risk of condensation (it was to be noted that controlled ventilation could be provided if required).
(vi) Warm air could be conducted to a cupboard for clothes drying. This feature was of particular importance in flats and the Ductair system could provide this more economically in capital and operating costs than the other systems examined. These required the use of independently heated (electric or gas) cupboards.
(vii) Allowed flexibility in planning.

Dr. Davidson claimed that the average weekly operating costs for a Ductair system, over a whole year, would range from 9s. 3d. to 16s. 3d., where the gas tariff ranged from 12d. to 21d. per therm.

Dr. Davidson compared the advantages of the Ductair system with heating by radiators and off-peak electric floor-warming. The main advantages he claimed were moderate capital cost (compared with radiators), low operating costs, and a high standard of convenience and comfort due to rapid heating up, freshness due to forced circulation of air, and lack of condensation.

Electricity and Gas Reports

Progress Helps Clean Air Campaign

Report and Accounts. 1st April, 1957–31st December, 1957; 1st April, 1957–31st March, 1958. H.M.S.O., 14s. 6d.

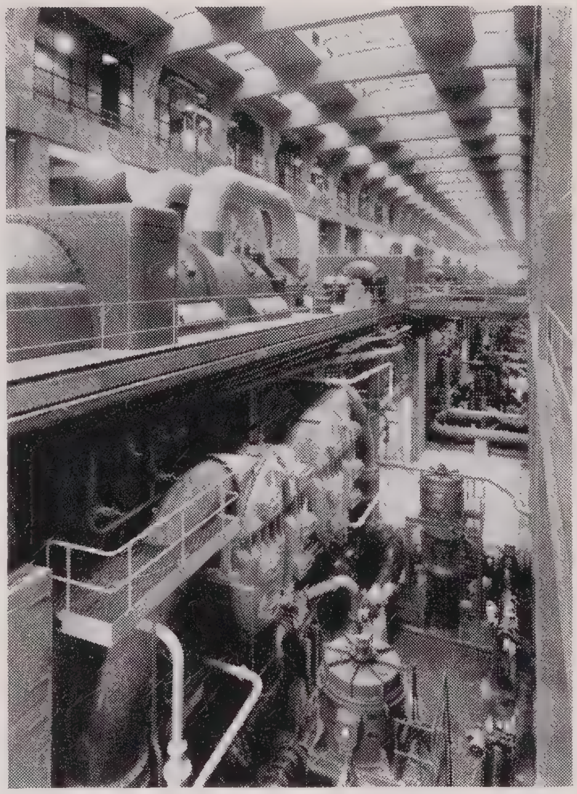
THE Central Electricity Authority, which with its predecessors the British Electricity Authority, had been in existence since vesting date, 1st May, 1948, came to an end on 31st December, 1957, under the provisions of the Electricity Act, 1957, and its place was taken by two new bodies, the Central Electricity Generating Board, responsible for power generation, and the Electricity Council, with supervisory powers over the whole industry.

Over the 9¾ years of the Authority's existence the output capacity has developed from some 10·3 million to 22·25 million Kilowatts. Although wages and costs of materials had increased by 70 per cent., the capital cost per Kilowatt installed remains at £50.

During the 9¾ years, 55 new steam stations have been started up; but, since 550,000 Kilowatt of plant has been shut down, there remained in operation, at the end of 1957, 262 generating stations compared with 291 at vesting date. The overall thermal efficiency rose from 20·91 to 25·38 per cent., and as a result an increase of 81 per cent. in the fuel consumed was responsible for an increase of 115 per cent. in output.

The output in 1957 amounted to 70,425 million units compared with 32,669 million during 1948, the average price per Kilowatt to consumers rose from 1·144d. to 1·534d.

In making comparisons between the operations of the Authority during the years 1948 and 1957 it should be remembered that on 1st April, 1956, the Authority's South-East and South-West Scotland Divisions, were handed over to a new Authority, the South of Scotland Electricity Board.



Turbines and condensers at the new Hams Hall C Station near Birmingham—from the Electricity Report

The Generating Board continues the policy of the Authority in planning development years ahead, and for the years 1958–63 it is proposed to install some 12 million Kilowatts, including some 1½ million Kilowatts of nuclear plant, outstanding from earlier programmes, and it is expected that some two million Kilowatts of older plant will be shut down. For the second year in succession, the maximum demand was met by available plant without reduction of voltage or load-shedding.

Air Pollution

The Generating Board continues to give great attention to the reduction of

Progress on Reactor No. 1 *at Berkeley Nuclear Power Station in Gloucestershire, to be opened in* 1961

atmospheric pollution, and before and after the opening of new power stations, surveys of deposits and sulphur content were carried out. Preliminary results indicate that in the area near a power station, concentrations of sulphur gases at ground level are less than have been predicted on a theoretical basis. Experiments have been carried out to ascertain the short term rate of dust deposit in the area under the plume during periods of rain.

The flue gas washing plant at Bankside " B " operated efficiently and that at Battersea " A " worked satisfactorily but at a lower efficiency.

In the experimental gas-washing plant at Nottingham, sulphur dioxide is removed from flue gases, and utilized to convert to ammonium sulphate and elemental sulphur the ammonia and sulphur compounds in ammonia liquor from a neighbouring gas-works.

Some 8·4 million tons of ash are produced yearly at power stations, 3·8 million being fine dust from pulverized fuel boilers. Research is being carried out on the manufacture from the latter of cellular building blocks, etc., and commercial plants are already working at Battersea, Hams Hall and Earley.

On 31st March, 1958, the Generating Board owned 253 power stations with a maximum output capacity of 22,343,000 Kilowatts. The plant extensions in view include 60,000 Kilowatt sets at 1,500 lb. per square inch and temperature of 1,050°F., 100,000 Kilowatt sets at 1,500 lb. per square inch and 1,050°F., 120,000 Kilowatt sets at 1,500 lb. per square inch and 1,000°F. and a 200 Kilowatt unit at 2,350 lb. per square inch and 1,050°F. There are also envisaged 275,000 Kilowatt units at 2,300 lb. per square inch and 550,000 Kilowatt sets with two-line turbine to operate under similar steam conditions, the first of which it is proposed to install at Thorpe Marsh, Doncaster. Attention is also being given to the production of turbines operating at super-critical pressure. There are now more than 100 generators with hydrogen-cooled rotor windings in commission. A 30,000 Kilowatt set with water-cooled stator windings is also giving good service.

A 3,750 Kilowatt pilot power station to be operated in conjunction with the underground gasification scheme of the National Coal Board is under construction at Newton Spinney in Derbyshire. Work is now proceeding on the pumped water storage schemes at Rheidol and Ffestiniog in North Wales.

During the year 168 miles of the 275,000 volt super grid were brought into use making the total constructed or approved 1,822 miles.

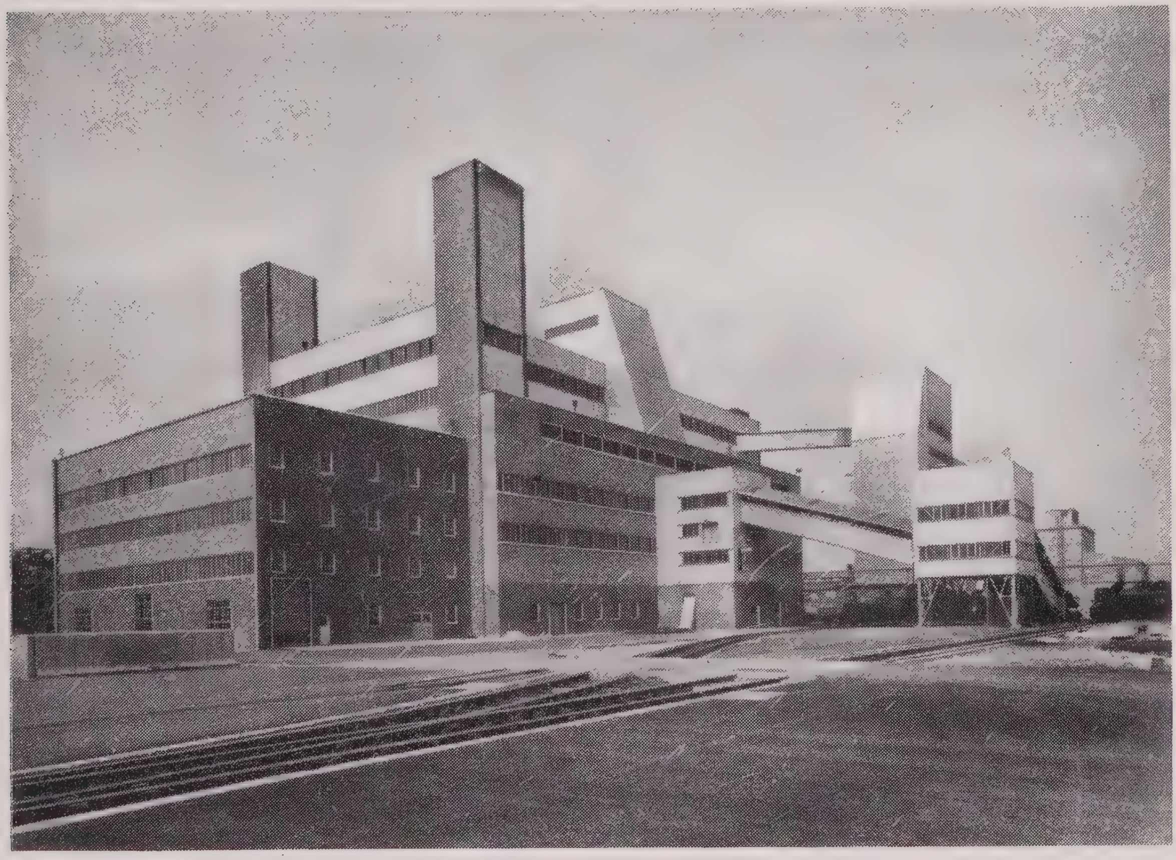
43·8 million tons of coal, 806,000 tons of coke breeze, 913,000 tons of oil and 50,000 tons of other fuel were consumed during the year.

The number of consumers turned over during the year from D.C. to standard voltage was 68,300, making a total net reduction from 775,000 to 229,500 since vesting day. The number of consumers remaining on non-standard voltage at the end of the year was 1,898,000.

The combined revenues for the year totalled £473·96 millions of which £230·63 millions were expended on generation and small purchases of electricity and £125·37 millions on capital charges, mostly depreciation and interest. The surplus for the year amounted to £16,062,039, making with the surpluses for 1948–9 to 1956–7 a total of £98·5 millions.

The Gas Council Annual Report and Accounts for the year ending 31st March, 1958. H.M.S.O., 10s. 6d. net.

THE progress made by the gas industry in its provision of two smokeless fuels is a matter of importance to organizations and individuals interested in clean air. During the year under review, progress has been made in the production of gas



The new production station of the N.W. Gas Board at White Lund, near Morecambe, built to a design approved by the Royal Fine Art Commission from processes and sources other than the established practice of carbonizing coking coal. Attention has been given to precise methods of assessing the quality of coke. A specification for the quality of gas coke for use in approved appliances was passed to the British Standards Institution in November 1957. This is under consideration.

Sales of gas amounted to 2·651 million therms, an increase of 1·7 per cent., and the average revenue per therm was 20·2d. Home sales of coke and breeze totalled 10,310,000 tons and exports to 988,000 tons. Consumers numbered 12,875,987.

The quantity of coal used for gas-making was 26,025,000 tons, in addition to 579,000 tons of oil. During the year the manufacture of coal gas was decreased and the production of water gas stepped-up to reduce growing stocks of coke. With many new smoke control areas envisaged, adequate coke supplies should be available. At the end of the year there were 2·16 million tons of gas coke in stock at gas works and 1·99 million tons of hard coke at coke ovens.

New gas-making plant with a capacity of 124 million cubic feet a day was brought into commission and plant having an output of 136 million cubic feet of gas a day was scrapped. Of the new plant, 11 installations, with a total capacity of 39 million cubic feet a day, were for the gasification of oil. Twenty-five oil gasification plants are already in operation.

The length of mains increased during the year by 2,000 miles to 92,000 miles. Production ceased at 75 more stations, and at the end of the year, of the 1,050 inherited by the Area Boards, only 536 remained in operation.

New Processes

The outstanding feature of the year under review is the progress made in the development of new processes and sources for the supply of gas, necessitated inter alia by the increasing scarcity of coking coals.

A process for the high pressure hydrogenation of oil or coal has been evolved at Solihull, and a plant on a commercial scale is being erected at the Partington works of the North-Western Board.

In Scotland a plant, with an ultimate output of 30 million cubic feet a day, is being erected for the high pressure hydrogenation of opencast coal.

The North Thames Board has made arrangements for the importation of liquefied natural gas from America for delivery at Canvey Island and transmission to Romford to be re-formed to the characteristics of town gas.

The search for natural gas continues. Supplies are now being taken from a well at Cousland to Musselburgh.

The South-Eastern Board is erecting a plant at the Isle of Grain for gasification of whatever fractions of oil may be available from the adjacent refinery of the Shell Company's refinery. The ultimate output is expected to reach 60 million cubic feet a day.

The West Midland and Wales Board have arranged to take fire-damp or methane drained from the mines of the National Coal Board. The Scottish Board is making similar arrangements.

The North Thames and Southern Boards are receiving supplies of tail gases from the distillation of crude oil, from the refineries of the Shell Petroleum Company at Shell Haven and the Esso Petroleum Company at Fawley respectively. The North Thames Board proposes also to take a further supply from the Coryton Refinery at Shell Haven.

Under the Clean Air Act, the Minister of Housing and Local Government, and the Minister of State for Scotland have made orders whereby the provisions of the Act with regard to the emission of smoke, grit, dust or fumes from gasification plants will be enforced by the Alkali Inspectorate and not by local authorities.

The Area Boards are prepared to give advice and assistance to property owners and industrialists as to the provision and conversion of plant to avoid the emission of smoke.

Butane storage tanks at Beckton Gas Works

The co-ordination of the activities of Area Gas and Electricity Boards is under the consideration of a departmental Committee.

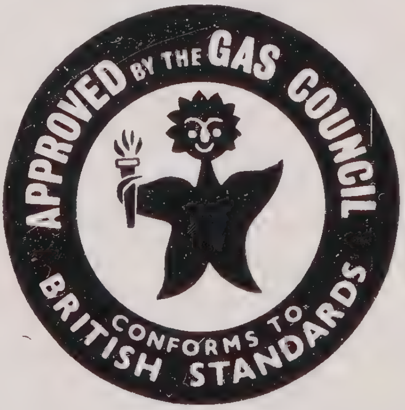
Research has continued in domestic appliances for the use of gas, and, during the year, were produced gas cookers with automatic time control, convector fires of higher efficiency, and a low price refrigerator. Domestic cookers with protected automatic ignition, for use by physically handicapped people, are now available. A central-heating system for houses, in which air from a central heater is circulated through controlled ducts to various parts of the house, has been developed. In a new house the cost may be no more than that of chimneys and fireplaces.

To prevent the sale of unsatisfactory appliances, items included in the Gas Council's List of Tested and Approved Appliances will in future bear a " Seal of Approval," presenting " Mr. Therm."

Sales of gas to industry were higher by 5·2 per cent. and the industrial gas engineers of the Boards continue to give advice and service in solving industrial problems.

In the ceramic industry some 330 gas-fired ovens are still in use; but some 600 coal-fired bottle ovens remain that will have to be converted under the Clean Air Act.

The aggregate result of the year's trading was a net surplus of £2,820,610, on a gross income of £380·6 millions, after charging £24,213,066 to depreciation and £20,472,329 for interest.



The Gas Council's new " Seal of Approval "

The Ninth Des Voeux Memorial Lecture

Clean Air, Urban Amenity and the Growth of Towns

by

Sir William Holford
D.Arch., F.R.I.B.A., M.T.P.I.

Read at the Llandudno Conference, 3rd October, 1958

Introduction

RECENTLY, in Central Africa, I had the opportunity to visit some of the sites chosen by the original Bushmen for their encampments. I noticed that while the lip of the cave or the shelf of rock on the side of the hill gave them a strategic view over the surrounding country and its game, some of the sites also made use of fissures and chimneys in the rocks behind, through which the tell tale smoke of their own fires could be carried through the hill and dispersed some distance away.

I am not one who believes that history repeats itself; but I cannot help being struck by the way in which certain basic human requirements keep recurring through the centuries, not always in the same way or for the same reasons; and invariably calling out a new technical response from the age in which they reappear.

Last year Sir Graham Sutton gave you an exceptionally interesting address on *Meteorology and Air Pollution.*[1] He began by doubting whether we should ever " . . . entirely control the natural processes by which noxious substances emitted into the air are diffused. The real remedy ", he went on to say, " is to stop putting such substances into the atmosphere, but since, at the present time, this is a counsel of perfection, we are justified in inquiring closely into what happens to the foreign matter when it has been introduced."

In the light of the knowledge and skill then prevalent, the primitive hunters must have known as much about airflow and smoke diffusion for their own purposes as Sir Graham Sutton does for his; and the more serious reason why I have made this somewhat mischievous comparison is because the phrase " a counsel of perfection " illustrates so well the dilemma in which town builders have been placed ever since town building began. Unpolluted air must always have been desired in the building of huts, camps, castles and—eventually—cities. Homer is the first of a long line of storytellers, architects and scientists who have told us so.

Even when chimneys were out of fashion in the building of the great classical country houses of the eighteenth century, the ingenious Colen Campbell, at Mereworth in Kent, took all the flues from the fireplaces round the ribs of his central dome and out through a copper cupola at the top.

The difficulty is that while private comfort and private amenity are often available—though sometimes at great cost—public comfort or public amenity of the kind required when " men come together in cities ", as Aristotle said, " to live the good life ", are always subject to more imperative requirements of the community, such as its defence, or its economic subsistence.

But you have not asked me to talk about town building in the past, nor about the way in which historic towns have avoided or endured the hazards of smoke and fog and sulphur dioxide. You have asked me to talk about air pollution, in relation to town planning; and although no one concerned with the study of environment can escape the past or ignore its lessons, yet the accent is clearly on what can be done, now and in future to give back clean air to a country that is becoming ever increasingly urban and industrial. This, at least, is what I understand to have been Dr. Des Voeux's objective, sixty years and more ago; and it is the theme of the Lectures which you have instituted in his memory. I am glad that you have devoted the ninth in the series to town planning, especially as the subject of town planning, as it is now understood, is a newcomer when compared with the subject of smoke abatement. Although I can tell you nothing of scientific importance—as some of my predecessors have done—I shall try to draw some interesting parallels between our respective activities.

Town Planning: A Comprehensive and Continuous Process

Perhaps the best way to establish these parallels is to make clear some differences; and they are very great. Clean air is at any rate a finite and foreseeable objective—like winning a campaign in a war. To win a campaign does not solve a nation's problems, as we have good reason to know. But it completes one operation and provides an approach to the next one. Similarly, the elimination at source of the greater part of our air pollution by industrial and domestic waste, would still leave problems of temperature inversion, frost pockets and fog. But at least one arduous operation would have been successfully concluded, and the Society could once again—and most honourably—change its name!

Town planning has no finite objective in this sense. In its modern form it is a formal and continuous process for regulating the use of land, controlling various aspects of our physical environment and providing opportunities (and sometimes designs) for new construction and development. It is inexact as a science, and as an art, imperfect and somewhat tentative. Nevertheless it provides a method—the only one our urban and industrial society has evolved—whereby waste, friction and inconvenience in our daily movements can be progressively reduced, ever larger populations accommodated, the amenities preserved and extended, and more reasonable —if not more imaginative—settings created for our life and our work.

Along this line of progress the achievement of clean air in town and countryside would be a major victory. In this paper I hope to show that when working to a vast and many-sided programme, such as town and country planning, the only way to show results which will encourage the public—or should I say ourselves, in our public capacity—to take further steps towards the Ideal City, which from time to time we dream of but never reach, is to mark the milestones as we go along. The achievement of smokeless air would represent such a milestone; and it is still some way off. But beyond it are further milestones on the same road: how to deal with the products of the internal combustion engine (four million gallons of petrol a day are consumed in Los Angeles[2]); how to dispose of atomic wastes, as Dr. Bronowski forecast in his 1951 Lecture[3]; how to supersede cooling towers; how to cleanse our rivers.

These and many other technical problems are with us, and their complete solutions still lie ahead. They are inseparable from the problems of social waste in which town planners and urban sociologists are now deeply involved, such as traffic congestion, the uneconomic nature of the long journey to work, and the rate of obsolescence of dwellings.

It is clear that the town planner must look to the scientist and the industrial technologist to find solutions to specific technical problems. These will all make for the better physical climate and the more productive environment for which he is trying to plan. But, in return, the town planner can contribute something from what I can only call—and you must excuse the jargon—his inter-disciplinary experience. He can also suggest some of the techniques of collaboration; for the technical advances have to be carried out within the framework of economics, of law and public administration, and of social custom, which all regulate the pace of planning and of any subsequent development which results from it. And if you ask what particular interest an architect has in this process, my reply is that the architect is trained to it, even though his responsibility, as an architect, may not go beyond an individual building. The essence of his training is design—that is to say, the method by which a number of technical means are used for aesthetic ends. This is fundamentally the same process as that of the painter and sculptor; only that the means of designing buildings—and still more a housing estate or a town—are more complex and less personal than those in the fine arts. They are also more highly organized from a social point of view and need more elaborate co-ordination.

In short, the end product of the town planner's research and designs, and of the presentation of his proposals, must be visible as buildings, landscapes and roads, or as patterns of settlement and land use.

A Chart of Town Planning Activities

In so far as such a process can be systematized, town planning—in a small and highly developed country such as ours—may be said to consist of a number of general aims, which remain constant, and a number of controls, which vary from time to time and place to place, but which are necessary in a democratic society to define these aims and compare one with another. For the fact is that if any one objective is pursued on its own, it will come into conflict with the others. For this reason the supreme planning function of the Minister of Housing and Local Government, as laid down by statute, is to secure consistency and continuity in the use and development of land.

At the risk of appearing academic, I would like to summarize these aims and these controls. There is a good deal of misunderstanding of what town planning is about. To some it is just a dirty word; while others credit it with a capacity and an authority it has not got. Moreover a chart of town planning activities is the clearest way of exposing my subject, which is the relation between clean air in particular and an improved environment generally. You will notice at how many points they touch each other.

The Countryside

1. The first aim is to preserve and improve the means of natural recreation. This may seem the opposite extreme to town planning, but in fact it is a reflex; for the bigger and more urban our population becomes, the more essential it is that solitude and wildness, sparsely inhabited areas and national parks, the woods, the moors and the coastline, should not lose their natural quality. The category stops short of real desert; for it must be recognized that what natural recreation means to an urban population is a contrast of amenity, not the loss of it altogether; while, to the rural population, the national parks are much less important. The effect of drift pollution on every kind of natural amenity—on atmosphere and visibility, on animal and bird life, on hill grass and hill farming, on the whole ecology of an undeveloped area—can be easily understood, even

if a good deal of detailed research remains to be done. Smoke particles can be carried hundreds of miles, and a recognizable smoke pall at least thirty; while the average life of a sulphur dioxide molecule has been estimated at two to three days. As, apart from natural air turbulence, no economically practicable defence can be put up by remote districts, the only remedy in this case is the absence of pollutants—the " counsel of perfection " referred to by Sir Graham Sutton. Even green belts must otherwise be tinged with grey.

2. The next aim is to reserve the most suitable remaining land that is still undeveloped, for agriculture, forestry and the rural occupations and industries associated with them. This means also the improvement of housing, transport, social services and public utilities for those who work on the land. The effects of air pollution here are much the same as for the more remote country districts; but of course they are strongly accentuated in the neighbourhood of industrial towns, and the economic and social consequences are more serious. Hill farmland, in particular, which normally has a higher rainfall than the average for the country as a whole, already runs the risk of soil deterioration through erosion and leaching, and this is made much more serious if the air is polluted and if impurities are also present in raindrops and other forms of condensation. Foresters and farmers then complain of retarded tree and crop growth, of poor pastures, deterioration of stock and reduced milk yields. Dr. Alice Garnett of the University of Sheffield, discussing the geographical factors of air pollution,[4] has demonstrated the relationship of rainfall acidity to sulphur dioxide, with particular reference to the Don Valley. And anyone who remembers the disastrous effect on the prize livestock exhibited at Smithfield during the London fog of December 1952, will appreciate how vulnerable the animal world is to atmospheric pollution.

Housing

3. The next aim of town planning is to facilitate housing, in all its forms, and particularly in regard to its location, its quantity, its quality, and its social arrangement. There is always a housing shortage. It is either general—as at the end of the last war—or it affects particular areas, types or income groups, or it is accentuated by slum clearance and what the Americans call " urban renewal ". With every form of housing, atmospheric pollution is intimately connected; and in most of our towns housing is not only the chief source of smoke, but also constitutes the reception area most adversely affected by it.

Up to a point, the higher the density of the housing, the greater the density of the smoke. This was certainly true of the so-called 'by-law' streets in our industrial towns, where dwellings at 36 or more to the acre were designed to cast 85 per cent of their domestic fuel into the air or onto the chimney flues. It was also true of central London when it was on the average three floors high, and even more so in the nineteenth century when it became five floors high; for there were then more flues to the square mile. The steel frame and the electric lift broke the height barrier. Now that blocks of flats are being constructed 9, 11, 14, and 16 floors high, it is obviously becoming uneconomic, from a building point of view alone, to carry flues from each dwelling to the top of the block. The truth of the old saying: " where danger is salvation also lies ", is demonstrated by the fact that such flats are now being equipped more and more with direct and off-peak electric heating, using both radiation and thermal storage[5].

Yet the hard core of the domestic smoke problem remains. There are still large concentrations of obsolete equipment in otherwise habitable houses, and the Treasury imposes a heavy Purchase Tax on gas and electrical heating appliances—including domestic storage heaters. Even new blocks of dwellings with flat roofs seldom possess means of carrying chimney gases from central furnaces high enough into the air to escape lee eddies and down draught. Housing estates are still located in frost pockets and in areas subject to frequent temperature inversion and consequent fogs. (This is contrary to the advice which a meteorologist or a micro-climatologist would give the housing or the planning authority, but such advice is either considered irrelevant or is outweighed by other considerations such as land values and availability, or nearness to a bus route or railway station.) As the town planner can only influence present and future development, his best course is to support in every possible way the combined operations envisaged by the Clean Air Act, and pay particular attention to the characteristics of new land for housing and of the type of dwelling and of equipment proposed to be installed there. (In this connection I shall refer later on to the importance of the decisions taken on the form in which a particular town is allowed to grow.)

Public Services and Utilities

4 and 5. Next in order among the aims of town planning are those intended to facilitate transport and communication, and to provide for the public utilities such as water and drainage. The effect of fog on all forms of traffic, except underground traffic, is patent; but it is not precisely calculable in terms of cost. On aviation, however, it is decisive. And it is a pity that Gatwick, newly opened as an alternate to London Airport, cannot produce a truly alternate fog pattern. But little seems to be known, at present, of the other side of the picture—the effect on air pollution of the combustion of diesel oil and petroleum in millions of vehicles on the roads, and the annual discharge of some 25 million tons of carbon monoxide. That there is some injury to health is obvious from their effects, under conditions of relatively stable air in the middle of towns, on those who are irritated by exhaust fumes and are even allergic to them. But the extent of the damage, in the absence of other pollutants, does not appear to have been calculated, except in very special cases. It would also be interesting to know whether it predisposes certain people—as heavy cigarette smoking is said to do—to carcinoma of the lung.

Here again the only town planning remedy lies in trying to reduce the worst concentrations of traffic—particularly in streets and semi-enclosed places where natural ventilation and air turbulence is below the average. Simultaneously a great deal could be done by adopting Sir Hugh Beaver's suggestion that toxic motor exhausts should be dealt with in the same way as the scheduled processes: i.e. by continual informed challenge[6]. (Under the Town Planning Acts the problem of advertisements is approached in much the same way.)

6. The next objective is to make provision for the generation and distribution of energy. This aim, in so far as it means gas and electricity, is in line with the objects of this Society. It is most completely so where atomic fuel is used, and normal air pollution problems are absent; such as smoke, grit, ash disposal, SO_2 and other toxic gases—for it now seems clear that there is not likely to be another accident such as occurred at Windscale.[7] As one goes down the scale of generation, however, the heat, light and power processes become less susceptible to control, either by town planning or under the Clean Air Act. While power stations and Gas and Coke Works are scheduled under the Alkali Act, electricity generating plants which burn less than 500 tons a day, for industrial purposes, are not.

From the town planner's point of view the public is more concerned over the distribution of electricity than over the loss of amenity caused by the incomplete combustion of solid fuel—probably because the former is more visible and makes an easier scapegoat. Yet the latter is thoroughly wasteful as well as damaging, whereas the former is an efficient means of distributing energy and as it becomes even more efficient will achieve a greater distinction of design and greater simplicity.

It is a curious feature of an industrial country such as ours, that while the approach to both roads and railways has been one of continually improving the engineering design itself by public criticism, competition and imaginative skill—so that names like Macadam and Telford, Stephenson and Brunel, have become household words—the distribution of electricity, in which we lead the world, is regarded with almost universal prejudice as a necessary horror which should be put underground and out of sight, like sewage. I sometimes wonder whether the next century will see a movement for the preservation of old power stations and pylons, as there is now for old railways and for Cornish Engine Houses.

One further point about power station chimneys is perhaps worth making: it is that their height should no longer be governed by an arbitrary rule of two-and-a-half times the height of the boiler house, but by a calculation in each case which would take account of topography and airflow, the maximum concentration of smoke at ground level (which varies inversely with the height of the chimney), and the temperature of the stack gases before diffusion.

Despite all the technical precautions that can be taken it is sensible to secure a safe location for coal and oil-fired generating stations and for gas works: i.e. downwind from at least the more concentrated centres of population.

Industry and Commerce

7 and 8. Next on the list are industry and commerce—our major sources of livelihood—whose zones of activity are not only important in the campaign for clean air, but also the most controversial in town planning theory. Early legislation, with an eye on the black legacy of the nineteenth century industrial towns, naturally segregated special or noxious processes from general industry, and both from residential use. In detailed layouts planners went even further, and distinguished between " clean " and " dirty " factories.

When I prepared the layout for the Team Valley Trading Estate at Gateshead in 1936, I allocated an area at the windward and more rural end of the estate for firms who might wish to manufacture under specially hygienic conditions: e.g. patent foods, cartons, photographic material etc. Meanwhile, Special (now known as Development) Areas legislation, the Barlow Report and the Distribution of Industry Act of 1945, all helped to induce industry to move from the big cities—and especially from London and the south-eastern region—in the interests of a more balanced employment structure. The wartime plans for the County of London[8] and Greater London[9] carried industrial segregation policy a stage further, and tackled the problem of " non-conforming " industries and backyard factories in residential areas; although the Greater London Plan made an attempt to except what it called " service industries ", defining them according to their domestic character, innocuous processes, and the small numbers employed. Finally, the Town and Country Planning Act of 1947 established the Use Classes Order and the need for planning permission to change land or premises from one use class to another.[10]

No sooner had this segregating mechanism been set up than it had to be overhauled. In the series of post-war economic crises (which are still with us) capital expenditure for new building and war-damage replacement, as well as for re-location and regrouping into tidy use zones, could not be supplied to the extent desired. In the second place, office employment grew very fast in relation to factory employment, and " employment " rather than " industry " became the principal factor in the town planner's struggle for a less congested pattern of population and land use. And in the third place there was a growing number of reasons why factories were becoming cleaner and more neighbourly. There were, for example, improvements in fuel techniques, a reduction in night shifts, and an increase in the so-called " footloose " consumer industries, using electric power and a high proportion of female labour, and capable of setting up almost anywhere in the country where this was available.

All these changes made general industrial segregation either less practicable or less important. At the same time the exceptions—including noxious trades and processes with nuisance value in a residential community—were being more clearly identified.

Modern town planning practice, therefore, while it still favours for many reasons the principle of grouping together similar industrial uses, is now much more selective in its definitions. It admits the advantages of having certain categories of employment—especially commercial and service industry[11]—in or near residential zones, while giving special attention to dirty, noisy and smelly trades, and to works scheduled under the Alkali Act. It is worth noting that certain industries not likely to be included as scheduled processes under the Clean Air Act may still be dealt with by local authorities under the Town Planning and the Public Health Acts.

Social Organization

9 and 10. Lastly, town planning seeks to assist all forms of social organization. This is a town's main function; and it includes educational and health services, the means of debate and assembly, universities and cultural institutions, opera houses, concert halls, museums and galleries, the seats of local or central government, churches, monuments and shrines.

Air pollution directly affects the health services—and the veterinary ones also—but in the operation of the social services its role is, naturally, indirect. But insofar as these activities and services are represented by buildings, then the discharge in Great Britain during a year (in this case 1954) of two million tons of smoke, eight hundred thousand tons of grit, and over five million tons of sulphur dioxide, is a matter of very serious concern.[12] For these buildings include many of our historic structures, buildings of social and architectural interest, cathedrals and churches, sculpture and monuments, whose economic life is much longer than that of normal houses, offices or factories, and whose " restoration " has to be faced. Appeals for such restorations already known to me at the present time amount to a total sum of nearly fifty million pounds; and there must be hundreds of which I have not heard. Dilapidation is not all due to atmospheric pollution, but a very high proportion of it is; and it ranges from valuable and irreplaceable items such as the Grinling Gibbons sculpture on the walls of St. Paul's Cathedral in the City of London, to the small box hedges which will no longer grow at Aston Hall, in Birmingham.[13] Under the Town and Country Planning Act, lists are slowly being completed of all the buildings of " special architectural and historic interest " in England and Wales, and it is likely to number over 100,000. Under the Historic Buildings Act, Parliament votes annually a sum of upwards of £250,000 to help their owners to maintain some of the most outstanding examples. As an architect and as a member of the Historic Buildings Council for England, I realize how much farther this small sum would go if the main source of building dilapidation could be eliminated or even reduced. For this, as well as many other reasons, therefore, town planners will be anxious to see the programme fulfilled whereby 400,000 to 500,000 urban acres a year are brought progressively within the boundaries of Smoke Control Areas.[6]

These ten positive aims of town planning, which I have just summarized, add up to the sum of urban development, but they do not make towns. A town must have some unity and character of its own, differentiating it from other towns, and derived partly from its situation, partly from its social form and characteristics, and partly from the economic basis of its life. The shell of the society which the town represents has either grown slowly over the centuries, or is custom built in the first place—whether as *Villeneuves* in the reign of Edward I, or as *New Towns* in the reign of George VI. In either case the growing points of development and redevelopment at any period will substantially change the form of the town—or the city or the village, as the case may be. They may also alter the town's response to the changing environment of which it forms a part. Knowledge of these responses, and skill in the kind of civic design which will adapt the town to its environment—physical, social and economic—is the real essence of town planning. In relation to the omnipresent factor of air pollution, it is, therefore, worth looking at one example of the town, not as an assembly of parts, but as a complete organism.

Satellite Growth Versus Spread

In the remaining period during which air pollution by domestic and industrial concerns is still very much a problem—although a gradually diminishing one—some thought might be given to the ways in which a town spreads.

A good illustration is afforded by a comparison of the two university cities, Oxford and Cambridge. Both are free of drift pollution from nearby industrial districts. Both are prone to high humidities. It is true that Oxford, like London, with its generally concave topography is more subject than Cambridge to the downward creep of cold air from the hill slopes, and that the katabatic breezes lead, during anti-cyclonic weather, to temperature inversions and valley fog. But there can be very little doubt that air pollution not only contributes to the fog condition but prolongs it; and in both cities the pollution is mainly of local origin.

Oxford has appealed for more than two million pounds to assist the repair of decayed stonework. Cambridge has invited contributions and grants for the normal restoration of individual buildings and groups, but for nothing of this order of magnitude. Oxford grew in the nineteenth century from 12,000 to nearly 50,000 inhabitants; Cambridge from 15,000 to 38,000.

It was during this period that the individual coal fire became entrenched, not only in the closely packed terrace houses but in the college quadrangles as well; and it is only since the Second World War that it has begun to diminish in numbers and effect, and after 1921 both cities experienced an abnormal growth in houses and population. The continuously built-up area of Oxford now contains a population of about 120,000 and Cambridge about 104,000.

In a most interesting study called *Smoke Over Oxford*,[14] Dr. Beckinsale and Mr. Combey (the Chief Public Health Inspector) mention the four sources of pollution there as:—

(*a*) domestic: particularly the nineteenth century terrace houses;
(*b*) collegiate: also a dense form of residential use;
(*c*) manufacturing industry: including the older factories and works west of the centre and near the railway, and the newer and " cleaner " industry at Cowley; and—
(*d*) public utilities, such as gas and electricity generation and the railway yards.

They also point to recent reductions, due to diesel-electric locomotives, improved boiler equipment, a new housing estate established initially as a smokeless zone, and increased use of electricity. They quote one college which burnt two hundred and thirty five tons of solid fuel in 1929, and thirty years later is burning less than twenty. But 85 per cent of that solid fuel must have been wasted, and through this very waste, millions of pounds worth of damage was done—some of it irremediable.

The comparative atmospheric improvement in both university cities in very recent years is impressive. But in this, as in other matters, town planning has to deal with the legacies of the past as well as with extensions into the future. There are many contributory reasons for the plight of Oxford's historic buildings besides the climatic ones. There is the very general use of pervious limestones, the town's higher industrial capacity on the transport lines between London and the Midlands, the sheer neglect of building economics and management (characteristic of university societies until quite recent times), and inversely the sheer beauty and associative importance of the buildings themselves. But one factor revealed by the studies of air pollution in both centres—and particularly so in the case of Oxford—is the increase of extent and of density in the continuously built-up area. And here Oxford and Cambridge policies diverge.

To the best of my knowledge, Cambridge is the only town in England (I except from this list the two garden cities, Letchworth and Welwyn, and the County of London), which has deliberately used its powers under the Town and Country Planning and the Distribution of Industry Acts, to limit its urban spread.[15] Cambridge, city and shire, decided in their Development Plan, and it was approved by the Minister, that a town twice as big would not have twice the advantages of a Cambridge roughly its present size. On the contrary a great number of amenities would be lost. Residential and industrial expansion should, therefore, be encouraged in surrounding villages or satellite centres, and (with certain exceptions and " infillings ") discouraged in Cambridge itself, which would gradually be modernized by redevelopment rather than by peripheral extension.

The importance of this decision in reducing some of the problems of atmospheric pollution will readily be understood.

In Oxford, on the other hand, if my interpretation of the arguments supporting the city's claim to boundary extensions is correct, the policy is to accept the inter-war expansion of the built-up area as inevitable, and to be repeated. The corollary is that new Council estates, such as Blackbird Leys, will have to be not only declared, but actually built as smokeless zones; if the existing problems of pollution in Oxford are not to be worsened. From the point of view of general progress towards clear air in housing estates, this will, of course, be a step forward, and it serves to illustrate another example of the way in which smoke abatement and town planning can provide alternative policies.

My own view remains, however, that their activities should be complementary.

Conclusion

In this brief review I have outlined the town building process, emphasizing the positive features of urban development and referring them to one item in particular in the list of checks and balances which I have called *Controls*—namely, Clean Air.

There are, of course, many other controls on the regulatory side of the town planning process. There are other anti-pollution controls affecting water and industrial effluents, surface mineral workings and noise. There are regulations governing advertisements, road signs and petrol filling stations. There are building byelaws and planning restrictions that limit use, height and density. All these attempt to regulate development in the interests of public amenity, safety or health.

There is a second set of controls which derives from publicly accepted preservation policy, although the means are partly official and partly dependent on informed public opinion.

It includes nature conservancy, access to commons, footpaths and mountains, the preservation of trees and of ancient monuments and historic buildings.

There are also economic restrictions on every form of development, which are often decisive in matters of amenity and preservation. The Treasury control normally takes the form of saying " We cannot afford it ", to which public opinion often replies " We cannot afford *not* to do it ". And the result is one of those inevitable compromises of which all regulatory town planning consists.

But there is also a fourth set of controls where compromise in this sense does not figure, and that is design itself. For design is also a control, by means of selection and imagination, over the raw materials of land and building development. Site and cost and building programme all establish conditions within whose limits the designer has to work; but as design is essentially a creative act—an expression of personality—any further compromise or indecisiveness after the programme has been established is a defect. And this applies as clearly to the design of a new town as it does to the design of a power station or of a street lighting column.

I have always felt strongly that the control of air pollution is one of the most important of these town planning controls. Its importance is social, economic and preservationist; and for these reasons it should be a factor in design. And it too seldom is.

On the other hand, I want to end on a plea for simplification. I have tried to show not only the complex nature of the combined operation we call town planning, but also the conflicts that are bound to exist between a number of legitimate interests, all desirable and even necessary in themselves. Only when the final aim is very clear, or the emergency overriding, are these forces and pressures resolved. It is just conceivable that one could design a perfect heating system, but it is inconceivable that anyone could design a perfect town, this side of the pearly gates, at any rate. Therefore the identification of objectives becomes essential; and so does the training of staff to exercise in an intelligent way more than one control. Local authorities are largely responsible for the supervision of air pollution, and almost entirely for town planning—both under the same responsible Minister. Sir Hugh Beaver's Committee referred to the shortage of staff as one of the main stumbling blocks in the way of the administration of an effective clean air policy.

I may not be popular with town planning officers and their committees in pointing the obvious moral. But if the planning staff cannot actually supplement the Health Inspectorate in administering this control, it seems clear that liaison between them should be as close and as labour-saving as possible.

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THE WEST RIDING CLEAN AIR CAMPAIGN

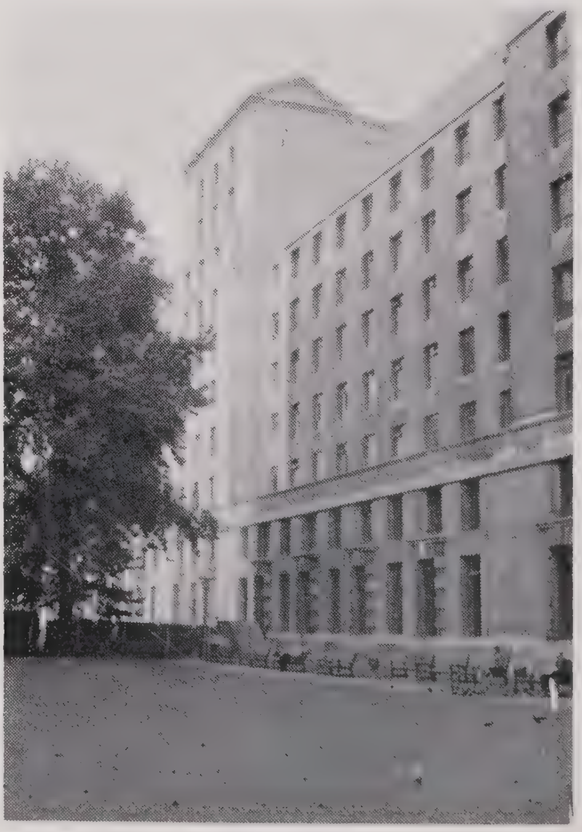
On the pattern of the previous campaigns in the West Midlands and the North West, the West Riding campaign is now in full swing, and is going well. It is being run under the auspices of the West Riding Clean Air Advisory Council, and is taking the form of exhibitions in the most important centres in the area. The National Society for Clean Air is co-operating with its modest but effective series of display units, and among other bodies participating are the Department of Scientific and Industrial Research, the Gas and Electricity Boards for the area, and the Solid Smokeless Fuels Federation—the last-named once again doing the major part of the organization.

The campaign started at Wakefield on 22nd September, with an opening ceremony by the Rt. Hon. Arthur Creech Jones, M.P. Since then the exhibition has been at Ossett, Dewsbury, Castleford, Shipley, Halifax, Batley, Barnsley and (December 4th to 13th) York.

The programme for 1959 is as follows: January 6th to 10th—Bradford; 20th to 23rd—Keighley; February 2nd to 7th—Brighouse; 10th to 14th—Huddersfield; 24th to 28th—Pontefract; March 10th to 13th—Morley; March 31st to April 4th—Doncaster. The final exhibition will be at Leeds, towards the end of April.

Factory Equipment Exhibition

A two-day conference on clean air, designed to be of value to factory managers, etc., is to be held in conjunction with the Factory Equipment Exhibition at Earls Court next April. The N.S.C.A. is represented on an advisory committee planning the programme of the conference, which will be opened by Mr. Gerald Nabarro, M.P.



New Government offices in Whitehall. Compare the part on the left, just being completed, with the nearer part, up since 1951

"THE EFFICIENT USE OF FUEL"

New, Revised Edition

The Efficient Use of Fuel. Ministry of Power. pp. 888, 35s., H.M.S.O., London.

Spurred on by wartime needs, one of the best things done to promote the standards of fuel usage in this country was the publication, in 1944, by the then Ministry of Fuel and Power, of the first edition of this textbook. It has been widely used, both by students and in industry, but since it was written there have been many changes and developments in fuel technology, and a new and substantially revised edition of the work is to be warmly welcomed.

The first edition was edited by Dr. G. E. Foxwell, who was also chairman of the Editorial Panel for the new edition. The preface to this bears his signature (with that of Dr. R. J. Sarjant, as Chairman of the Ministry's Education Committee) and is dated a few weeks before his death in April of last year. Dr. Foxwell served the cause of fuel efficiency well and untiringly (and was a firm friend of this Society) and it is work that should live after him in this volume.

The editor of the new edition is Dr. Charles Forrester, of the Ministry of Power (and its representative on the Society's Technical Committee), who is to be congratulated on the all-round quality of the contents of the new volume and the way in which they are presented. The preface mentions that he also contributed much of the new material and additional features.

One of the first points to note about the book is the value for money—compared with many other textbooks today—that it gives 888 large octavo pages, with numerous line diagrams and charts, for 35 shillings is remarkable. There are 30 chapters, four useful appendices and an excellent index. All the main uses of fuel in industry appear to have been covered, and the chapters on the fuels themselves and on the principles of combustion are clearly and succinctly written. There are a few references to the Clean Air Act, and both the prevention of smoke and the removal of grit and dust from flue gases are dealt with in a direct and practical fashion.

We are glad to see that the diagram from Fuel Research Technical Paper No. 55, which shows so conclusively how smoke and fuel losses are linked together, is reproduced. The prevention of smoke is described briefly and firmly:

" To consume smoke, there must be sufficient secondary air, adequate mixing of the air with the volatiles, and a sufficiently high temperature zone in the combustion space to ensure that combustion takes place rapidly before the gases come into contact with any colder surfaces.

" The *amount* of carbon in dense smoke is small; the real danger of waste due to smoke lies in the possible presence of unconsumed invisible combustible gases. On the other hand, attempts to avoid the production of smoke by using unnecessarily large amounts of excess air can cause more serious heat losses. A chimney serving a furnace working on bituminous coal should be neither quite clear nor definitely smoky; the plume should just be visible as a light haze."

It is not possible to detail the contents, but they include, for example, chapters on pulverized fuel and the cyclone furnace, boiler auxiliary plant, furnaces, waste heat recovery, space heating, instrumentation and thermostatic control.

Any Smoke or Public Health Inspector who needs facts and explanations on matters relating to fuel usage will find this volume a very useful desk book.

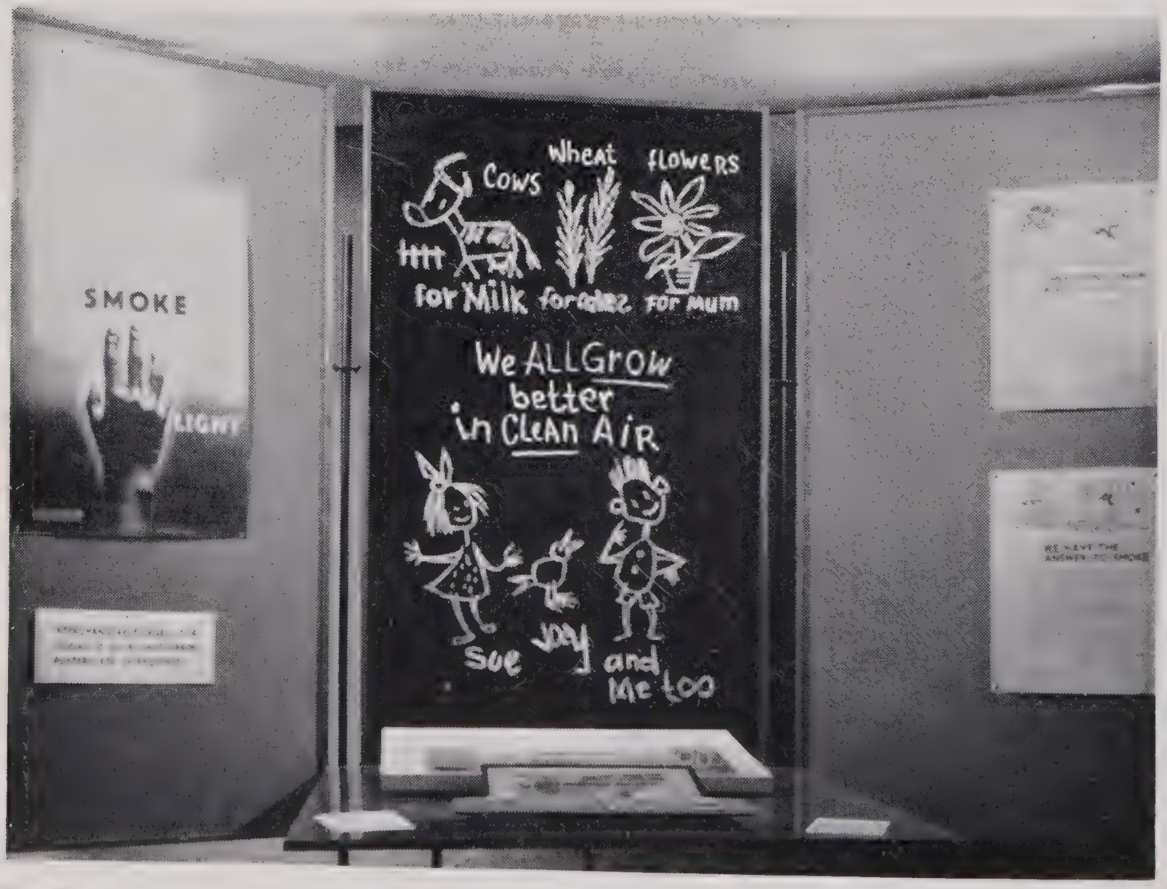
Enthralling Work Ahead

Opening the Public Works and Municipal Services Congress and Exhibition at Olympia on 10th November, the Minister of Housing and Local Government, Mr. Henry Brooke, spoke about the clean air campaign. In this part of his speech he said:

"In ten years from now I believe we can drive away the dirt in the air which shuts out the light of the sun. What is drab and dim we can make clean and clear. We can save life too, for dirty air is a killer. Public authorities must give the lead if they want everyone to co-operate. So have a look at your heating plants in town halls and council offices and swimming baths and schools. Look regularly at the refuse destructors and the tips. See that all the Council's trucks and buses are so well serviced that no visible fumes come from the exhaust.

"The Ministries are doing all they can to prevent smoke from public building; the Minister of Power and I have been in touch with all our colleagues in the Government about that. Local authorities can make byelaws requiring that all domestic heating and cooking appliances in new buildings in towns must be suited for using smokeless fuels. Nearly 500 urban authorities have made these byelaws by now. Why not the rest? I advise them to hurry up.

"I want to see every urban authority determined to drive forward till they have got the air in their town clean. There is new work ahead; valuable work, enthralling work. For if we all drive forward together in the assault on pollution, the reward will be immense. We need the co-operation of the man in the street, and the woman in the home, and the man in the boiler house. In every town and city we must think out together how best to get it."



The Society's new "prototype" portable display unit, with centre panel, side wings for posters or local exhibits, and table. Designed for easy packaging and transport, it is hoped (as funds permit) to have a number of these for loan to local authorities and others

The President at Newcastle

A Clean Air and Fuel Efficiency Exhibition, organized by the Health Department, was opened at Newcastle-upon-Tyne on 6th November by Sir Hugh Beaver, the Society's new President.

Sir Hugh said that there may be clean air over Britain in fifteen years' time, but there was a tremendous leeway to make up, and he hoped Newcastle would go ahead with smokeless zones faster than it had done so far. If we were going to secure clean air in fifteen years we would have to create smokeless zones at about the rate of 300,000 acres a year.

" It is two-and-a-half years since the Clean Air Act was passed," he continued, " it is six years since the London smog roused the whole country to action; and it is four years since my committee reported."

" So far as I can calculate, the total area which has been declared to be smokeless, or is going to be, is less than 60,000 acres."

Alderman Chapman, who is Vice-Chairman of the Health Committee (and a member of the Society's Council) said that Newcastle was starting a smokeless zone in April and it was hoped to have two more zones soon after.

Corrosion Due to Air Pollution

The following letter, from the Secretary of the British Association of Field and Sports Contractors Ltd., to the *Contract Journal*, and published in its issue of 11th September, is on a matter that will be of interest to those of our readers who are concerned with data on the effects of air pollution. The letter reads:

" We recently took steps to prove to a local authority that it is the considered opinion of manufacturers of galvanized wire that no manufacturer will guarantee such wire against air pollution.

" In spite of this, the authority has recently demanded that the contractor shall guarantee galvanized chain-link fencing for five years and claims that it is quite justified in making such a demand, as " many contractors " have accepted the liability.

" Have these contractors tendered without reading the contract clauses or are they so hungry for work that they are prepared to guarantee the moon? On the other hand, is it possible that they have doubled up the fencing costs to cover any eventualities? If this is so, the local authority will pay for replacement even though the galvanizing may not be seriously affected in the five years.

" We are advised that galvanized chain-link fencing manufactured to B.S.S.443 should last many years if not attacked by polluted air. In effect, therefore, the contractor has to guarantee that there will be no pollution within five years. This would seem hardly a contractor's risk!"

Flowers Grow in Ancoats

The Manchester University Settlement is situated in Ancoats, which used to have the reputation of being one of the worst " slum " areas in Manchester. It is a centre for carrying out pioneer and experimental work in education and social welfare, and in its recently issued annual report it describes a successful experiment with a new type of youth club. The report notes how its environment is changing:

" The clean air policy of the City Corporation, together with the introduction of diesel locomotives in the near-by goods yard, has had a remarkable effect upon the district, and flowers and vegetables now grow in the gardens of houses around us."

C.E.A. Conference

The annual conference of the Combustion Engineering Association was held in Scarborough on 11th and 12th November. On the first day the Fourth Progress Survey of N.I.F.E.S. was discussed, and the second day was devoted to a factual discussion between representatives of local authorities and industrialists concerned with efficient combustion, on the problems arising from the Clean Air Act.

NEW FUEL OIL TERMINAL AT POPLAR

The photograph above shows the new 18,000 ton capacity fuel oil storage and distribution station at Poplar, of which Charrington, Gardner and Locket & Co. Ltd., are the owners and operators. They are the sole distributors of Mobil fuel oil in twenty-four counties.

The Terminal was opened on 15th September by Mr. J. C. Grindley, Chairman of the Mobil Oil Company Ltd. The function of the installation is to facilitate the distribution of fuel oil from Mobil's Coryton refinery in Essex. This is brought by river in Charrington's own craft, and is discharged direct into the storage tanks at Poplar. It is thus brought to within three miles of the City of London, and onward distribution by road and rail is made more easily and reliably. It will allow prompt early-morning deliveries to be made throughout the London area without the risk of dislocation of supplies which might be encountered through heavy traffic or bad weather on the roads from Coryton.

The layout and technical arrangement at the depot have been carefully planned, and the installation has cost over £400,000. The barges are unloaded by three pumps of 250 tons per hour capacity, and the oil is stored in the tanks shown in the photograph. Four grades of oil are handled—heavy, medium and light industrial fuels and domestic fuel oil. Automatic pumping equipment feeds the oil from the tanks to the loading bays. This equipment, which eliminates manual control, ensures that nearly 400,000 gallons of fuel oil can be loaded per day, and that road tankers on site can be quickly filled with any quantity and type of product in storage. There are six loading bays and twelve vehicles can be loaded simultaneously and up to six with any one product at the same time.

The tanks for the heavy and medium oils are lagged and heated by steam coils. The ancillary plant includes a boiler house, a compressor house, a work repair shop, vehicle wash-down building, and a large administrative block which contains offices, mess room and showers for those employed on the site, and a centrally-heated locker for every driver.

Lung Cancer

The U.S. Surgeon-General, Dr. Leroy Burney, on 18th November, said that there was growing circumstantial evidence that polluted air is a cause of lung cancer. Dr. Burney told a national conference that dirty air also produced higher death rates for a number of other diseases.

News from the Divisions

EAST MIDLANDS

Visit to Castings Works

A visit of exceptional interest was made by members and delegates, 45 in all, to the works of Leys' Malleable Castings Co. Ltd., at Derby, on 23rd October. The party was welcomed by Mr. Peace (Director) and Mr. Buckland (Works Director) and included the Mayor of Derby (Councillor Mrs. F. Riggott), the Chairman of the Division (Councillor J. Dilworth, Derby), Mr. Alfred Wade, the Divisional Hon. Secretary, and Mr. Arnold Marsh, the Society's Director.

The delegates were shown over the new mechanized foundry, where a most extensive programme of modernization is being carried out. Of special interest was the equipment to prevent grit and fume nuisance arising.

The old coal-fired annealing furnaces were in process of demolition and had been completely replaced by electrically heated furnaces to deal with large outputs of castings. On completion, the new plant would reduce coal consumption from 1,000 to 450 tons per week.

A new cupola had also been installed and put on test. This was completely automatic and fitted with arrestors, and similar plant would replace other cupolas as opportunities arose. Automatic smoke density meters had been fixed in certain flues and were operating most efficiently.

The visit was most interesting and instructive, and demonstrated the efforts being made by this progressive company to improve efficiency, and to abate smoke, dust and grit nuisances. The delegates were entertained to luncheon by the firm, and the Chairman expressed the thanks of the Society for the Company's invitation to visit the works.

In the afternoon a meeting was held in the Guildhall, with Councillor Dilworth presiding, and was welcomed and opened by the Mayor of Derby, Councillor Mrs. Riggott, who expressed her close interest in clean air. A discussion on "Making the Clean Air Act Succeed" was opened with a short address by Mr. Arnold Marsh. He outlined the factors that were helping the Act to succeed, and the problems and difficulties that still lay ahead. He posed the question of whether the Act would now succeed without further effort, and said that it would not. If the efforts of the movement generally, and of the Society in particular, were to be reduced and wane, there would be failure. Many questions were put and there was an excellent discussion.

SOUTH EAST

A Forum on the Act

In conjunction with the "Clear the Air" Exhibition at the Royal Society of Health, the Division held a very well attended meeting on 10th November in the Library of the Society. With the Divisional Chairman, Alderman C. H. Smith, presiding the programme took the form of a forum to deal with difficulties arising under the Clean Air Act. The meeting was opened by three short addresses.

Mr. J. H. Massey, Senior Public Health Inspector, described the procedure that had been followed in Wandsworth in proposing a smoke control area and to the objections that had been raised. A petition signed by 23 residents had led to a Public Inquiry, and Mr. Massey quoted from a letter from the Minister after the inquiry, in which the points raised by the objectors were dealt with fairly but firmly. Mr. Massey said that the objections were mainly from elderly people with chest complaints, those who were anxious about the cost of conversions or fuel problems, those who considered that

A group of East Midlands members and delegates at the works of Leys' Malleable Castings Co. Ltd., at Derby

there was no smoke problem in the area, and those who resented such interference with their private lives.

A letter from Hampstead, where similar opposition had been encountered, was read later by Mr. Stubbs (for Mr. Matthews, the Hon. Secretary), in which the last point was again mentioned—the unalienable freedom of the Englishman to asphyxiate his neighbour.

Mr. J. Greene, Chief Public Health Inspector, Reading, followed with an address on the industrial aspects of the Act. He urged that the way to overcome the possible difficulties was to ensure co-operation and understanding with industry. Mr. Greene's references to their experience in Reading suggested that they were encountering few difficulties. They were giving sympathetic consideration to applications for temporary exemption certificates under section 2, and under section 4 were urging the installation of smoke density meters.

The third speaker was Mr. V. J. Froom, Chairman of the Society of Coal Merchants, who dealt with the problems of solid smokeless fuel supplies. He said that the fuel merchants wished to co-operate fully with the local authorities in implementing the Act. Because of other factors, however, co-operation was not enough. Most fuel distributors, he said, would prefer to deliver coke rather than coal, but they were disturbed by the shortage of what they called the premium fuels—Coalite, Rexco, Phurnacite, Cleanglow, and the like—which were very popular.

Mr. Froom emphasized that the existence of ample supplies of solid smokeless fuels was an integral implication of the Act, and that priority should be given to the black areas. He urged that there should be no isolated clean air pockets, unco-ordinated and unconnected with the main development, and taking smokeless fuels that were urgently needed in the black areas.

A lively barrage of questions and comments—mainly on smoke control areas and smokeless fuels—followed.

YORKSHIRE

Railway Progress

The Yorkshire Division visited York on 20th October, when they made a conducted tour of the motive power depot of British Railways, and saw the progress that has been made towards eliminating smoke. They were shown some of the latest types of diesel passenger trains and shunting engines, and also saw the new locomotive sheds which are being constructed to accommodate the new forms of motive power.

Earlier, a talk on the progress being made by British Railways had been given by Mr. T. Matthewson-Dick, Assistant Motive Power Superintendent for the North East Region. The fifteen year modernization programme he said, was now in its fourth year. Much of the work that was being done was unseen, and the general public was not, as a result, fully aware of how much was being done.

The motive power depot was itself an example of this. The major sources of smoke and dirt—the shunting engines and small steam locomotives—were rapidly being replaced, and over 100 of the small diesel engines were now in use in the North East Region. There were also the large 2,000 H.P. diesel electric locomotives, and the electrification of the main lines was proceeding—all these, said Mr. Matthewson-Dick, were major steps towards making the air cleaner.

ATMOSPHERIC DIFFUSION AND POLLUTION

Conference at Oxford

Report from Dr. R. S. Scorer

An International Symposium on Atmospheric Diffusion and Air Pollution was held at the Clarendon Laboratory, Oxford, from 24th-29th August, 1958. It was sponsored jointly by the International Union of Theoretical and Applied Mechanics and the International Union of Geodesy and Geophysics. The Chairman was Sir Geoffrey Taylor and the secretaries were Dr. F. N. Frenkeil and Professor P. A. Sheppard.

The proceedings will be published soon in book form as one of the series ‘ Advances in Geophysics.’ Most of those attending and by far the majority of papers were more concerned with atmospheric diffusion than with air pollution, and many *S*roblems which worry readers of p*mokeless Air* were simply not discussed. The measurement of air pollution in cities and the framing of legislation to deal with it are practical problems which we are content to solve gradually and by experience; but the problem of describing the air motion which produces diffusion presents difficulties which have so far proved insurmountable, and the impression gained at this conference was that the gross pollution of cities will be solved by its abolition before the diffusion is described mathematically.

Laboratory and theoretical studies of turbulence have not helped much in understanding a problem which is primarily a meteorological one, made difficult by the great variety of weather which can occur. If engineers who rather glibly use formulae for the dispersion of smoke could be made to realize that the high-powered theory behind them only relates to rather *special*, in some cases *rare*, and in most cases *not important* weather conditions they would be less happy about them. This conference should make it clear that engineers simply cannot have a formula which will tell them what the pollution will be from a given chimney, and on the whole they will find very little help from it unless they are prepared to understand more about meteorology and turbulence. But if they can make the effort to do this there will be great rewards, for although they will have no nice formulae, they will have a clearer idea of the nature of their task in preventing pollution at the ground.

At the lower theoretical level, that is outside the field of hydrodynamics, by far the most important paper was that by B. Peters. He described a technique whereby a measurement of the ratio of the amounts of beryllium and phosphorus and their radioactive isotopes in the air can be used to determine the recent history of the air. These isotopes are produced mainly by cosmic rays when the air is in the stratosphere. The air usually remains there for at least several months, often many years. If air of the stratosphere is carried down into the troposphere it is quickly (in a few days) mixed with other air and cleaned by rain. By applying this new technique it will be possible to trace the motion of air in the stratosphere, and of air which has recently entered the troposphere, much more reliably. This, of course, is large scale meteorology, but we are so ignorant in this field that the only theories of the air motion in the stratosphere that have been put forward are grossly naïve, and many simple and precious ideas look like having to be abandoned.

This is important because the stratosphere is a reservoir of radioactive pollution (particularly Strontium 90) put there by nuclear bomb explosions. The uncertainties are terrifying to contemplate and a little more light will be welcome.

Engineers who build the furnaces and chimneys which produce air pollution are in the habit of controlling their designs. It needs a new mental approach and much humility to grapple with the unsolved problems of the atmosphere. It is easy to joke about the inaccuracy of weather forecasts, but it is an unworthy pastime when practised by those who have not even troubled to understand the nature of the problems. When so much is at stake, as it is in the use of nuclear energy, it is not their (the meteorologists') fault but our (humanity's) limitations which have brought us to this brink. This conference showed that the collective effort of all nations is needed and that progress will certainly be hard and slow in understanding our atmosphere.

PERSONAL

Mr. S. N. Duguid, a Vice-President and Past-Chairman of the N.S.C.A. is Honorary Secretary and Treasurer of the North Western Fuel Luncheon Club, and at the final meeting of the last session in May he was presented by the members with a silver tea service, in recognition of his services over the past ten years, from the foundation of the club.

* * *

Mr. F. G. Brewer, O.B.E., who had been Secretary to the Gas Council since its formation in 1948, retired from that office at the end of September. The Council has appointed as his successor the Chief Accountant of the Council, Mr. Wilfrid Bailey, F.S.A.A., F.I.M.T.A.

* * *

Miss Mary Leigh, General Secretary to the Women's Advisory Council on Solid Fuel since 1953, retired on 31st October. She has been succeeded by Miss M. R. Schofield, LL.M., F.I.Hsg., Barrister-at-Law, who has been with the Council since 1954, and as Regional Secretary has been responsible for the implementation of the Council's policy of regional expansion.

Institute of Fuel

Among forthcoming meetings of the Institute of Fuel in London will be, on 25th February, 1959, a paper on "Investigations in Germany Concerning Atmospheric Pollution." The meeting, which is open, will be held at the Institution of Civil Engineers at 5.30 p.m., with tea at 5.

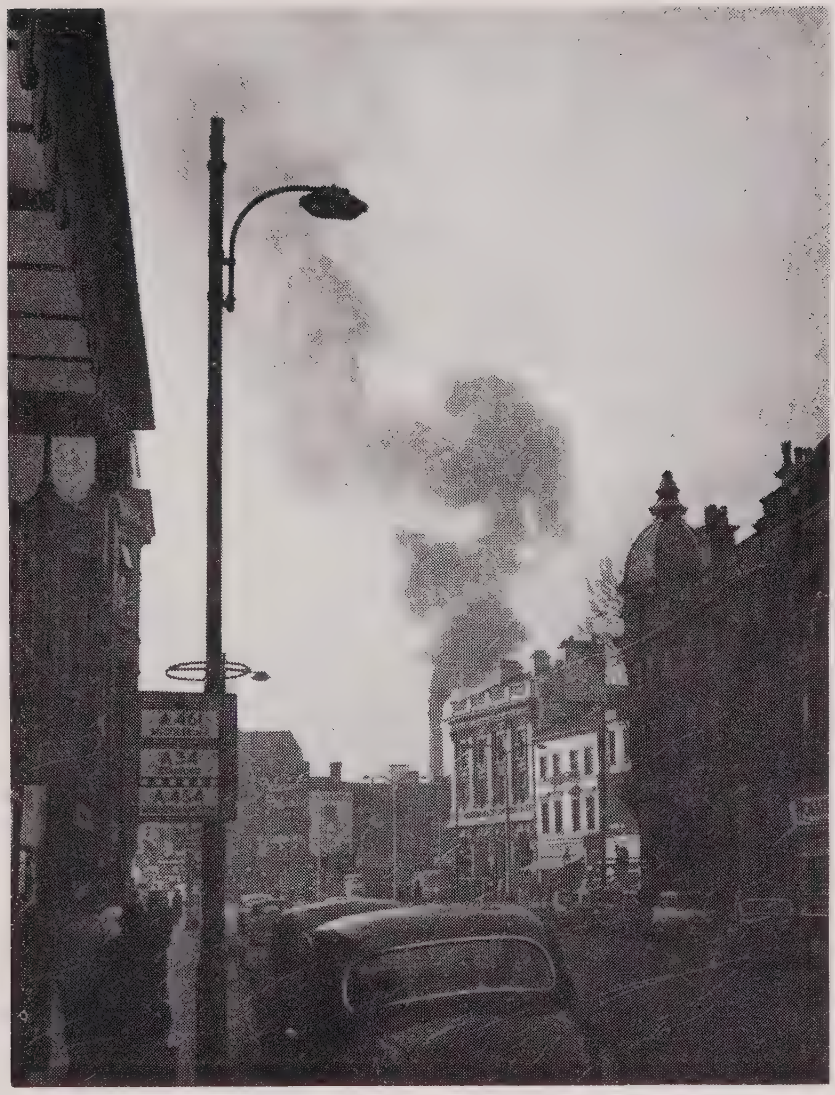


Photo-Library No. 33

Town Centre

Oil Smoke Abatement Wins Award

An unusual prize has been received by the Constructors Transport Co. of California, from the Clean Air Awards Committee of the Los Angeles Air Pollution Control District, for their successful smoke abatement programme. The company run oil-engined vehicles which have travelled nearly 2 million inter-city miles without any violation of the excessive-smoke regulations, and they are the first hauliers in America to receive an award of this nature.

The company enforce tests of each vehicle under full load conditions before it departs from a given terminal. When the engine is found to be running clean the fuel pump and rocker covers are sealed to prevent tampering. These seals are checked at the beginning and end of each trip, whilst air cleaners and air connections are checked at every fuel filling. The air-intake system is completely cleaned at fixed intervals and the fuel-filter element is replaced under a regular schedule. At specific mileages injectors are replaced.

Driver training is designed to prevent an engine being driven with the throttle in the maximum open position; furthermore, it must be run at 50-100 r.p.m. below the top governed speed, in all gears and under all driving conditions.

THE ROOM AND ITS HEATING SYSTEM

An Abridged verson of the winning essay in the Royal Society of Health's John S. Owens Essay Competition for 1958. The author is London Manager of Gulf Radiators, Ltd.

By

R. P. L. McMurtrie, M.A.(Cantab.)

PERHAPS it is as well, at the outset, to mention that heating—like many other things—is not an exact science. An engineer, in trying to arrive at a decision as to what medium of heating is to be used and the output necessary, does have to take into account many varying factors. In trying to decide on the best method of heating and type of appliances which are going to be used for the heating of a house, the ultimate conclusions must be largely governed by the standard which one wishes to attain (for people's ideas of comfort and the "right" room temperature do vary enormously); if it is to be full, background or intermittent heating and by the amount of money which is available for both the initial capital, running and possible maintenance costs.

The ideal to be achieved in heating is one of comfort and this depends really on two requirements; firstly, that there should be even temperature throughout a room and, secondly, that heat, however supplied, should be in the right proportion of radiation to convection.

The Scandinavians and Americans have done considerable research into the question of comfort in relation to heat and, because the human body at times needs radiation and at other times needs convection, it has been generally agreed that whatever type of heating appliance or appliances are used in a room, the total output from these should give you, as near as possible, 50 per cent radiation and 50 per cent convection. The heat then being emitted will be the maximum for the particular requirement of the individual. These proportions of radiation to convection hold good for whatever temperature is obtained and, therefore, if one is getting 50 per cent of both at 60° air temperature one is very much more comfortable than if one is getting pure convection only at an air temperature of 60°.

Dealing with the former point just mentioned about even room temperature, it can easily be appreciated that any room loses heat through its ceiling, floor, walls, windows, doors, etc. and if one has a wall 6 feet thick then the loss of heat through that wall would be very different from the loss through a 14″ cavity wall. Consequently, heating appliances should be placed, if possible, under windows to counter the "down-draught" or cold air radiation. All too often one finds a radiator situated neatly below a window but because it does not go the full width it does not overcome all the down-draught and, therefore, at least half the effect of the radiator is lost. Nowadays, with the advent of the thin lightweight panel radiator, it is possible to go the full width of a window or even the complete length of an external wall and prevent heat loss and counter down-draught so completely that one can more easily maintain an even temperature throughout a room. If one was to place the same appliance in a different position in the room, then the amount of heat transmitted from it would, in fact, vary, and even by moving the appliance a further few inches from a wall, under a window, the characteristics of its heat transfer are again altered. It is therefore essential to site appliances most carefully, for the effect can vary considerably by the very slightest alteration.

Controllable Heating

In this country, due to our temperate climate, heating has always been considered something of a luxury. Further, coal and other solid fuels which were the main source of heat in days gone by are mined in this country and, some years ago, were still comparatively cheap compared to what one had to pay in other parts of the world. Today, however, the cost of fuel, as we all know, is very much higher whilst our climate is still a temperate one. Any appliances used in this country for domestic heating must be easily controllable, that is, something that can be turned on or off at will, so preventing the slightest wastage of fuel and, consequently, money. It is not generally appreciated that radiator heating is, in fact, the cheapest and most efficient form of heating which is available today and considerable strides have been made in recent years so that domestic central heating from radiators bears no relation in appearance, running cost or efficiency to what is normally associated with the more old-fashioned type of radiators.

Perhaps a word about the cost of fuels will not be out of place. Electricity is roughly 2½ to three times as much as solid fuel whilst gas is somewhere about twice as expensive, whilst oil is somewhere about the same price as gas. If one examines the relative cost of fuels from another angle one can compare the cost by the actual useful heat given off from the various fuels, which in turn depends upon how efficiently they can be burned. For example, coke at 9s. a hundredweight when burnt at about 60 per cent efficiency, costs about 1s. 2d. per useful therm. Gas at 1s. 6d. a therm, can be burnt in a boiler to the extent of 80 per cent efficiency, representing a cost of about 1s. 10½d. per useful therm. Electricity at 1¼d. a unit used in an immersion heater is about 100 per cent efficient, and costs 3s. per useful therm, whilst oil, at 1s. 4d. per gallon, which is the cheapest rate one can purchase 35-seconds oil, namely in 500 gallon lots, when burnt to 75 per cent efficiency, costs about 1s. 7½d. per useful therm.

Solid Fuel Fires

At one time no house was built without solid fuel fires in almost all rooms; in the last fifteen years, fireplaces have tended to be confined to living rooms, and, today, one hears of houses where there is not a single solid fuel fireplace installed, and this is particularly true of many flats. There has, of course, been considerable discussion as to whether the solid fuel fire would be replaced by other heating appliances due to the fact that it does burn fuel extremely inefficiently and, further, does tend to increase the air change from the room very considerably by drawing air which is warmed in the room up the chimney. When selecting a solid fuel appliance, one should go for one of the new adaptor type of appliances which have the advantage of giving low radiation and convection. They are extremely efficient as they operate on a small and adjustable throat—as a result they do save considerable quantities of fuel for the amount of heat emitted. As an example, the ordinary open grate is probably about 11 per cent efficient, whilst the all-night burning grate—which was extremely popular some four years ago, is somewhere about 18 per cent efficient. The adaptor type of fire mentioned just now has an overall efficiency of about 40 per cent to 44 per cent, whilst the cosy type of stove, when closed, has an efficiency of about 65 per cent, but with the doors open this figure drops to about 34 per cent. The cost of one of these adaptor type of fires, including installation, is something of the order of £15. They fit any fireplace opening although no surround is necessary as they can literally be fitted in a " hole in the wall."

Many years ago, when solid fuel was very much cheaper, there came into prominence the fire back boiler which is still, regrettably, installed in many cases today. This is nothing more than a boiler jacketing installed behind an open fire in the living room so that the fire, when alight, heats the room and, at the same time, heats the water. Unfortunately, this appliance is not particularly efficient and, with the rise in solid fuel costs today, does not really represent an economic proposition, for it is doing virtually two jobs badly. The capital cost, as well as the running cost, of installing a separate water heating appliance with a solid fuel fire of the adaptor type mentioned, is far less than the capital cost and running cost of a fire back boiler which one would have to keep running during the summertime if one was to have hot water for domestic purposes.

Obviously, one could achieve more automatic control and automatic heating if one was to install one of the fully pressurised oil-fired burner units and, whilst for these to be really efficient it does necessitate using them in a specially designed boiler, extremely good results—as high as 77 per cent to 80 per cent—have been obtained by their use on converted solid fuel boilers. Two recent cases have shown that a modern one-storey house, consisting of a hall, kitchen, dining room, inner hall, cloakroom, living room and three bedrooms, has a running cost, with full central heating, of somewhere in the region of 17s. 6d. to £1 per week. This is of the small-bore pipe and panel radiator style mentioned previously with a fully automatic low capacity burner unit.

Central heating fired by a solid fuel boiler would probably cost between £30 and £40 per radiator for the whole system installed, i.e. if one is having four radiators from a solid fuel boiler, then you could reckon that it would cost somewhere between £160 and £200. The paraffin type of vapourising burner and boiler unit amount to something of the order of £50 as against a solid fuel boiler of about £40 so one could allow at least a further £20 to the above figure plus possibly another £20 or so for fuel supply. A pressurised burner unit for conversion of a solid fuel boiler runs between £130 and £150 with controls, excluding the radiators, etc., whilst the fully automatic boiler specifically designed for oil firing will cost at least £200 for the unit. If one, therefore, is going to install two radiators in the drawing room, one in the dining room, one in the hall, one on the landing, one in the kitchen, i.e. six radiators with a solid fuel fired boiler, one is probably running to a bill of about £220 to £280. To do the three bedrooms upstairs will cost probably another £90 and if one was to use electric radiators the cost, including automatic time switch and thermostat control, would be in the region of £60 to £65. If, on the other hand, one is going to use electric convectors, so that one has quick heat merely at the time that one requires it, then the cost will be of the order of £30 to £45.

Careful insulation does pay very handsome dividends in reduced fuel bills. Nowadays the problem of draughty doors and ill-fitting windows can easily be overcome by the use of Phosphor-bronze weather-stripping and plastic stripping of the foam type. Double-glazing is beginning to become a little more common, partly on the grounds of overcoming noise problems, but building costs today are such that the money expended on double-glazing is not really seen in the form of reduced fuel bills except over a very long period of time. Insulation of a roof space costs somewhere in the region of £6 10s. per house under consideration, while insulation of the cylinder and pipe lagging add up to something of the order of a further £8. These figures are, of course, approximate and do vary as costs increase but give some idea as to the extent of the initial outlay. Heat conservation by insulation is a most important matter and the writer personally thinks that much more attention should be paid to this point, not only on the design of a house but by owners on occupation.

MANCHESTER'S CLEANER AIR

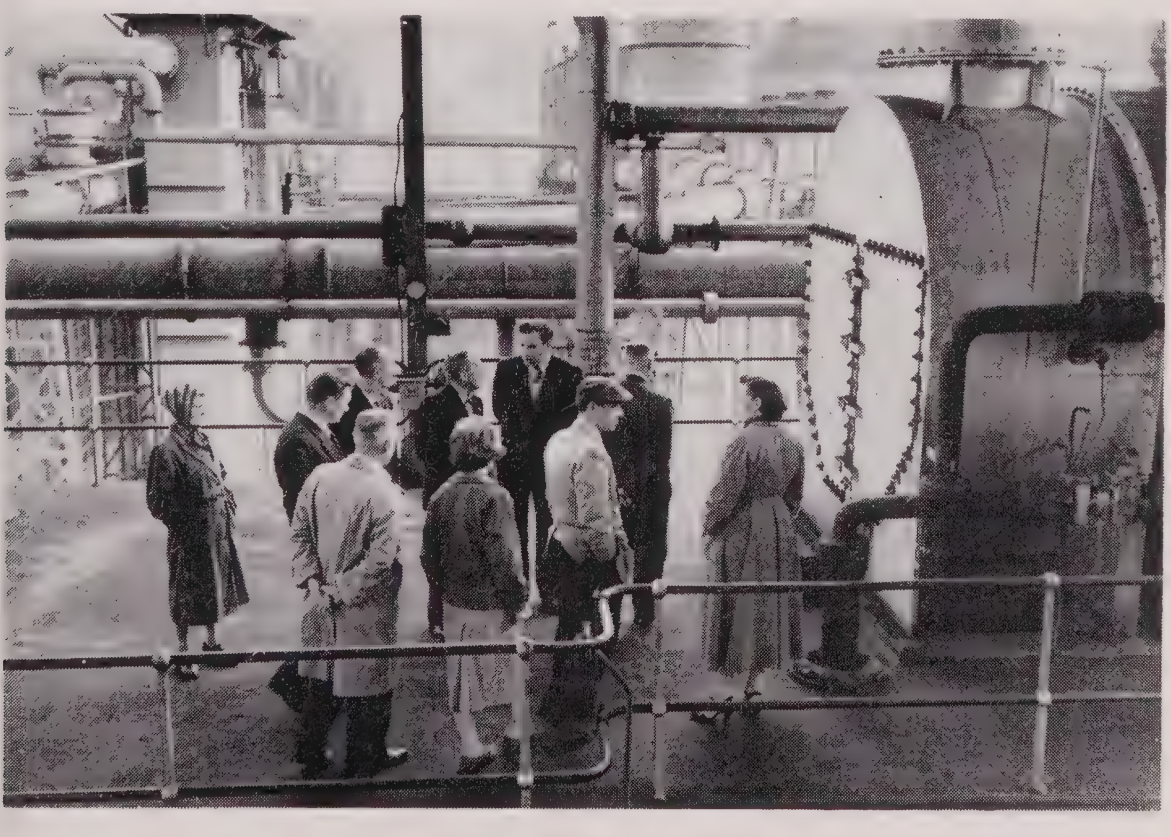
In a recent address to the North Western Fuel Luncheon Club, Mr. J. Graham, Chief Public Health Inspector for Manchester, said that there had not so far been any prosecution in Manchester under the Clean Air Act. He said that the Act was to be enforced by persuasion and only by coercion if that failed.

There was, however, a danger that people might develop a sort of " sales resistance," which could be unfortunate, and ultimately local powers were necessary to enforce compliance with whatever standards might be prescribed. Mr Graham said he felt that there had been enough evidence to justify the clean air policy since the close relationship between atmospheric pollution and bronchitis had first been established. Since Manchester's first smokeless zone was created, the atmosphere had been certainly cleaner. Visitors had noticed a perceptible difference in the city centre.

Manchester was now confronted with the biggest smoke control area in the country so far—one of five-and-a-third square miles at Wythenshawe. When the scheme was implemented, the amount of smoke falling on that part of Wythenshawe would be reduced by about 1,000 tons a year.

Mr. Graham hoped that Manchester would achieve what the Beaver committee on air pollution had set as its target in 1954—to reduce by 80 per cent atmospheric pollution in the " black areas " within ten to fifteen years.

Good Neighbour Policy in Practice—*When the inhabitants of the neighbourhood complain about pollution it helps if difficulties can be explained and if they can be shown how they are being dealt with. Two recent examples were a party of 117 citizens of Southend who visited the Coryton refinery of the Mobil Oil Company (above) after complaints about smells, and (below) a group of Uxbridge people who were invited to the local gas works to discuss complaints of smuts from an oil gas plant*



SMOKE PREVENTION ABSTRACTS

317. The Preparation of Smokeless Fuels for Domestic Use. O'Conner, J. G. (Univ. Sheffield Fuel Soc. J., **9,** 9–16, 1958). A review of existing knowledge on the preparation of smokeless fuels for domestic use is presented, with particular emphasis on the carbonization of single particles. The experimental work includes studies of carbonization in laboratory-scale apparatus when heating was by combined radiation and conduction and also by hot inert gas. A summary of the results of experiments on a pilot - plant scale is also given. (Author's Abstract.)

318. The Combustion of Coal Smoke. Underwood, G. (Univ. Sheffield Fuel Soc. J., **9,** 24–33, 1958.) Using an apparatus in which a tray of coal is pulled over an electric furnace, and the volatiles so produced burned with pre-heated air, it is shown that over the range of temperatures 650°C. to 850°C., the smoke burns in preference to methane and unsaturated hydrocarbons. Results show that at an air-smoke temperature of 750°C., 90 per cent. of the smoke can be burned in less than 0·5 seconds, using only 60 per cent. of the air theoretically necessary to burn all the volatiles. (Author's Abstract.)

319. The Automatic Determination of Sulphur Trioxide in Flue Gases. Crumley, P. H. et al. (J. Inst. Fuel., **31,** 378–382, September 1958.) An instrument is described for the automatic determination of sulphur trioxide and sulphuric acid vapour in flue gases in the range 10–100 p.p.m. by volume. The instrument operates by absorbing the sulphur trioxide in an isopropyl alcohol solution and precipitating it as barium sulphate; the optical density of the suspension is then measured photoelectrically. Tests have shown that the instrument gives results which are more consistent than those normally obtained by manual determinations made by established methods. (Author's Abstract.)

320. Activated Charcoal for Air Purification. Barneby, H. L. (Heat. Pip. Air Condit., Mar. 1958, **30,** 153–160). Activated charcoal removes gases and vapours from air by absorption. When used with heating, cooling, dust filtration, and humidity control, it permits the complete conditioning of air. Methods are presented for determining the load of contaminants to be removed and for selection and sizing of suitable equipment. The quantity of activated charcoal required to purify air can be predicted directly from the odour removal requirements, independent of the amount of air circulated. The methods presented are based on knowledge of vapours released, analysis of air, type of occupancy, survey by smell, and experience. (D.S.I.R. 12.)

321. Report New Method for Studying Air Pollution. Bourne, H. (Heat. Pip. Air Condit., Mar. 1958, **30,** 139–141). Atmospheric pollution in the Ohio River Valley caused by electric furnaces producing ferromanganese and ferrosilicon, was investigated. A portable electrostatic air sampler was used to collect smoke and fume samples 300 ft. downwind of the plant. The samples were collected and analysed for manganese, silica, total dust and fume, and the results are shown graphically. In the case of manganese, an association was worked out between the downwind distance, range of manganese concentration and the number of persons exposed to the pollution. The quantity of " dirt " settling out of the air on porches, window sills, etc., was measured by collecting it in polythene canisters. The results of these measurements, the geographical distribution of the canisters, and the analysis of the material so collected are given. (D.S.I.R. 43.)

322. The Clean Air Act, 1956—Twelve Months' Experience. Wyatt, J. H. (Roy. Soc. Hlth. J., Mar./Apr. 1958, **78,** 131–140; abridged in Heat. Vent. Engr., Mar. 1958, **31,** 432–436). An account is given of experience in Leeds by the Deputy Chief Public Health Inspector, mentioning difficulties experienced in regard to prior approval of furnaces and determination of industrial chimney heights. (D.S.I.R. 57.)

323. The Clean Air Act and the Steam Engineer: I, II and III. Rogers, E. C. (Steam Engr. 1958, **27,** Apr., 219–221, May, 259–261, June, 300–302). These three articles cover the application of the Clean Air Act in a practical manner.

323. Application of Dust-Collecting Equipment for Industrial (Boiler) Plant. Arlidge, P. E. (Sanitarian, Lond., Feb. 1958, **66,** 239–244). Preliminary considerations that affect the selection of dust-collecting equipment for small scale industrial boiler plant and which are discussed are: the distribution of particles emitted from stacks and the size analysis of dust from various sources of pollution (stoker-fired shell boiler, stoker-fired water-tube boiler and pulverized fuel-fired boiler). Types of equipment considered suitable for such installations and which are described in detail are: the low resistance collector, the turbo-collector (combined induced draught fan and grit arrester) and the tubular collector. (D.S.I.R. 62.)

324. Ceramic Filters for High Temperature Gas Filtration. First, M. W., and Graham, J. B. (Industr. Engng. Chem., June 1958, **50,** 63A, 64A). Fiberfrax is a ceramic fibre of about equal parts of alumina and silica plus small amounts of boric oxide, zirconia, or other fluxes. The fibres are formed by melting the ceramic in an electric arc furnace, then blowing and spinning. The fibres are then washed and formed into products such as paper, insulating blocks, and woven fabrics. Melting point is 3,300°F. and efficiency is not affected by continuous exposure to temperatures up to 1,500°F. (D.S.I.R. 146.)

325. Air Pollution and Steel. Pier, H. M. (Coal Util., May 1958, **12,** 29–32). Problems of air pollution control have been approached in many ways by the steel industry, and good progress is being accomplished. Discussion of what has been done and what lies ahead. (D.S.I.R. 207.)

326. The Smoke Problem and the Heavy Clay Industries. Green, A. T. (Claycraft, June 1958, **31,** 270–271). A brief review of operations in the pottery industry and heavy clay industry, indicating the smoke problem presented, particularly to the brick industry, by the necessity for firing in a reducing atmosphere. (D.S.I.R. 210.)

Correspondence

MECHANICAL STOKERS

The Editor
Smokeless Air
Sir:

We note that on page 25 of *Smokeless Air*, No. 107, reference is made to a representation by the Coal Utilization Council regarding a general exemption to furnaces fired by mechanical stokers in smoke control areas.

It may possibly be of interest to your members to know that this Association has also represented this matter to the Minister of Housing and Local Government and to the Secretary of State for Scotland, particular emphasis being placed on the granting of a general exemption rather than leaving this to Local Authorities who may differ greatly in their views. It is thought that perhaps you might care to make reference to this in your journal.

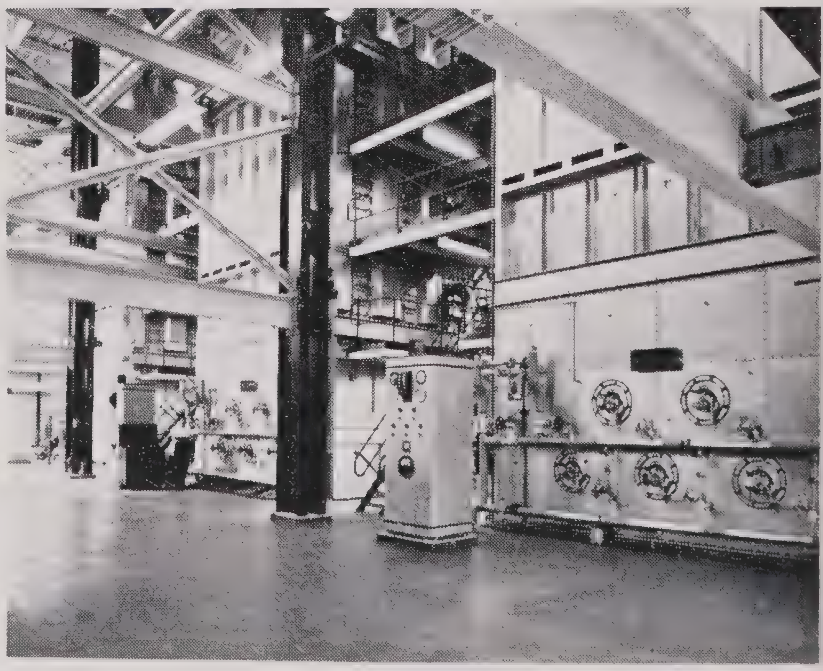
Yours, etc.,
J. V. Topham (Brigadier)
Director, The Combustion Engineering Association

VAUXHALL PLAN FOR CLEAN AIR

The new boiler house at Luton

We have been pleased to receive technical information and photographs from Vauxhall Motors Ltd. on their new boiler houses at Luton and Dunstable, recently completed as part of their expansion programme. Our special interest lies in the fact that the keynote of their Press release is the desire to make sure that the requirements of the Clean Air Act will be fully observed. To quote: " The designers of these essential factory services made sure, in the early planning stages, that all would be ready for the day when this important Act of Parliament could be implemented."

The new boiler house at Luton is fired by oil, and is equipped with automatic smoke alarms and recorders. The control room is one of the most elaborate private installations in the country. Each boiler has its individual control panel alongside the furnace, on the firing floor, and a duplicate set of controls is provided in the control room, where continuous records of all aspects of operation are made by automatic instruments.



Two of the three Lamont boilers at the Luton factory. Each has a capacity of 70,000,000 *B.T.U.s*

Fuel Efficiency Calculator

Petrofina (Gt. Britain) Ltd., of 25 Victoria Street, London, S.W.1, producers of Fina gas, diesel and fuel oils, have sent us a very neat and useful combustion efficiency calculator they have produced. Something like a slide rule, with a cursor and slide, it quickly enables stack loss percentages to be determined, given only flue gas temperature, nature of the fuel, and CO_2 percentage. It can be applied to six types of liquid fuels and six types of solid fuel.

100 Years Ago

In its column "100 Years Ago," the *Engineer* recently reproduced, from its issue of 3rd September, 1858, the following interesting account of efforts to prevent smoke from steam ships:

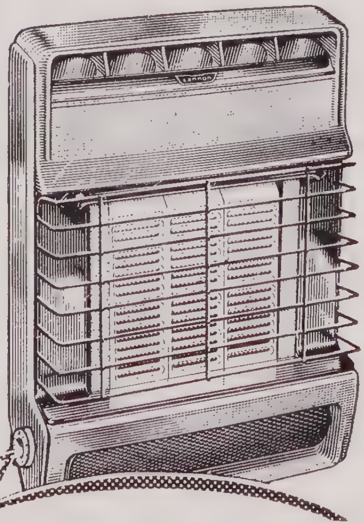
"CONSUMPTION OF SMOKE IN STEAM VESSELS."

"Some short time since the owners of steam-tugs plying upon the Tyne, to the number of 150, received notices from the Inspector of Nuisances of Newcastle upon Tyne, under pain of being proceeded against for penalties under a local Act, to consume the smoke emitted by their boats, which at all times, but more especially on the occasion of busy sea tides, when from 100 to 200 vessels have to be towed out at a tide, issued from the funnels of the steam-tugs in thick volumes of the blackest density. The tug owners thereupon consulted Mr. Armstrong, of Elswick, the engineer, and, under his advice, enlisted the services of Dr. Richardson and Mr. Reed, under whose superintendence experiments have for some time past been carried on, at Elswick, to prove the practicability of consuming the smoke produced by the coal raised from the great coal-fields of Northumberland and Durham.

"It was arranged that one of the steam tugs should be placed at the disposal of Dr. Richardson and Mr. Reed for the purpose of making such alterations in the furnaces, as they considered would effect the desired object, and in order that, in case of success, the other steam-tugs might be altered in a like manner. The Expert, steam-tug, belonging to Mr. William Melbourne, of North Shields, was offered for the purpose, and a series of experiments were made upon the furnaces, the plan adopted being very simple, consisting of a proper admission of air into the furnace, which, combined with careful stoking, was expected to consume the smoke. After certain alterations were effected the tug was taken to sea, with the Inspector of Nuisances on board, and it was found that the improvement effected was very great, upwards of 75 per cent. of the smoke being consumed, and the remainder being of a character far less offensive, being thin and light-coloured. The inspector considered that the result was very satisfactory."

Clean Heat with . . .

Cannon

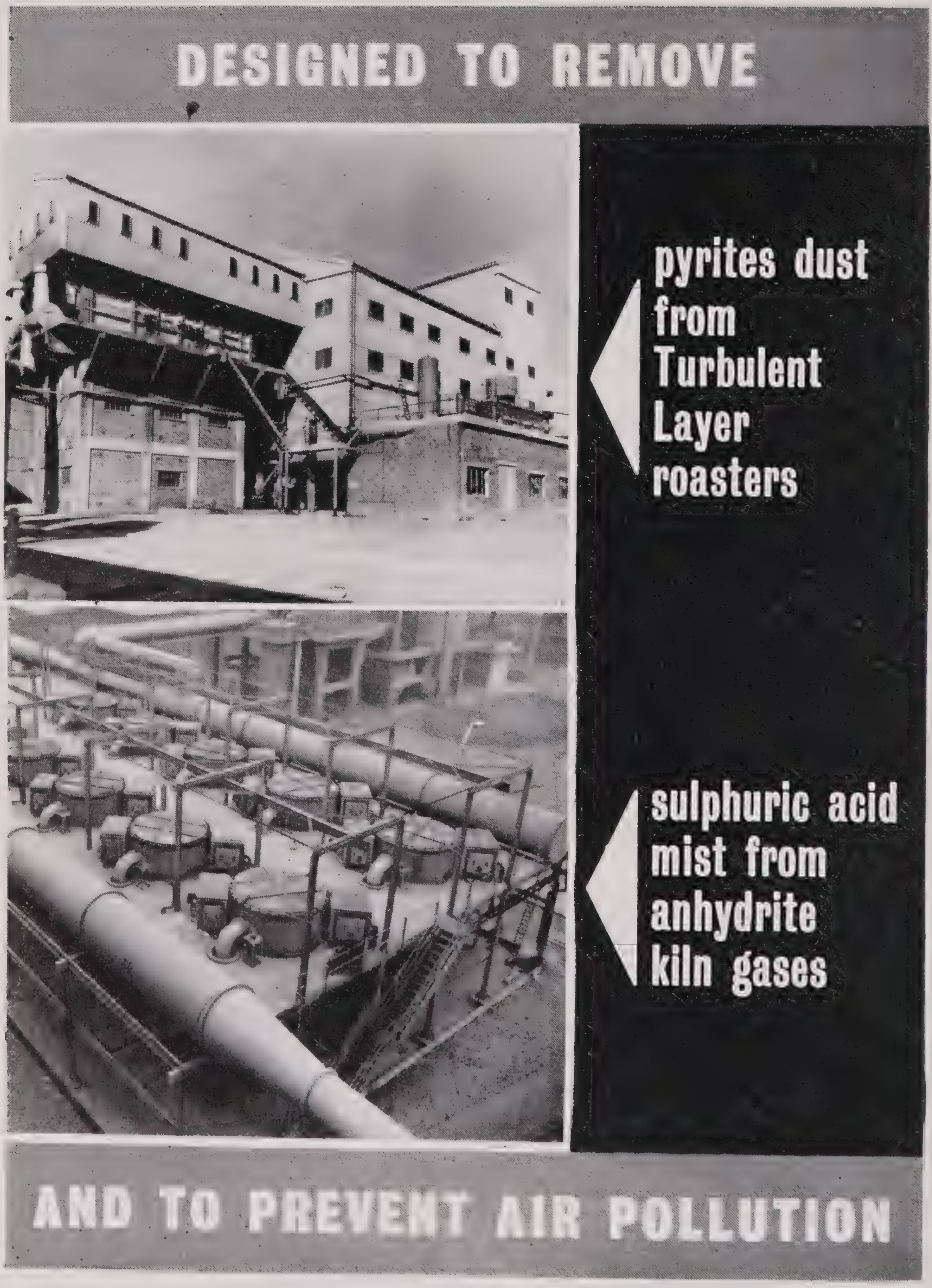


clean - silent - healthy heat -
the **'GASMISER'**
Britain's Best Room Heater

With the development of the Multyjet Convector and the GasMinder Automatic Room Heat Control, Cannon have made continuous room heating by gas a thoroughly economical proposition. More than that, the GasMiser is designed to match modern trends, is colourful, and clean in design as well as in operation. Here is a definite contribution to Clean Air—and to contemporary comfort.

with the **'GasMinder'** *thermostat control for first-rate economy*

For further details write to :—
CANNON (GA) LTD.
DEEPFIELDS · BILSTON · STAFFS.



DESIGNED TO REMOVE
pyrites dust from Turbulent Layer roasters
sulphuric acid mist from anhydrite kiln gases
AND TO PREVENT AIR POLLUTION

HIGH EFFICIENCY ELECTRO - PRECIPITATION BY

Simon-Carves Ltd

SIMON ENGINEERING GROUP

STOCKPORT, ENGLAND

OVERSEAS COMPANIES | *Simon-Carves (Africa) (Pty) Ltd: Johannesburg.*
Simon-Carves (Australia) Pty Ltd: Botany, N.S.W.

SC 197/PS

Smoke

vanishes

into

thin air

The Godber Smoke Burner will do the following:

1. Remove all fear of complaints from the Smoke Inspector under the Clean Air Act.
2. Give a working efficiency and a coal saving that will repay its costs in a few months.
3. Work automatically with boiler draught without "repair or renewal."

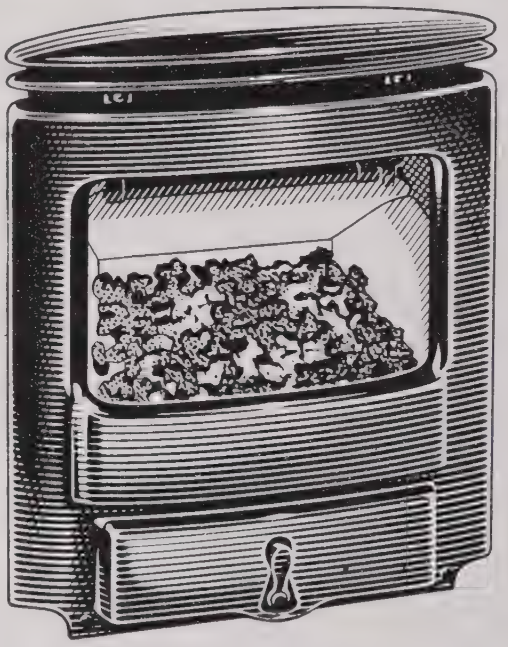
The cost (including fitting) for a *Lancashire Boiler is well under £300 and we fit on a basis of "no cure–no pay."

SMOKE BURNERS LTD.
130 Baslow Road, Totley Rise, Sheffield. Telephone Sheffield 71570
Registered Office: Park Foundry, 64 Park Road, Chesterfield.

*Can be fitted to handfired, automatic sprinkler or shovel stoker.

NEW PARKRAY 5

offers low cost smokeless convection heating



Designed to make convector heating available on even the tightest budget, the new Parkray 5 (list price from £11.18.0 according to finish) is ideal for the thousands of conversions to smokeless comfort now taking place in the new Smoke Control Areas.

The Parkray 5 fits most fireplaces—without builders' alterations—and burns any smokeless fuel most economically. A gas ignition burner is available for easy lighting: the controls are simple and the finishes are all wipe-clean. All round comfort for televiewing too—no wonder people find it a pleasure to 'go smokeless' when a Parkray shows the way.

Full details of the Parkray 5 and other Parkray convectors—including downdraught models—are given in the information sheets available from:

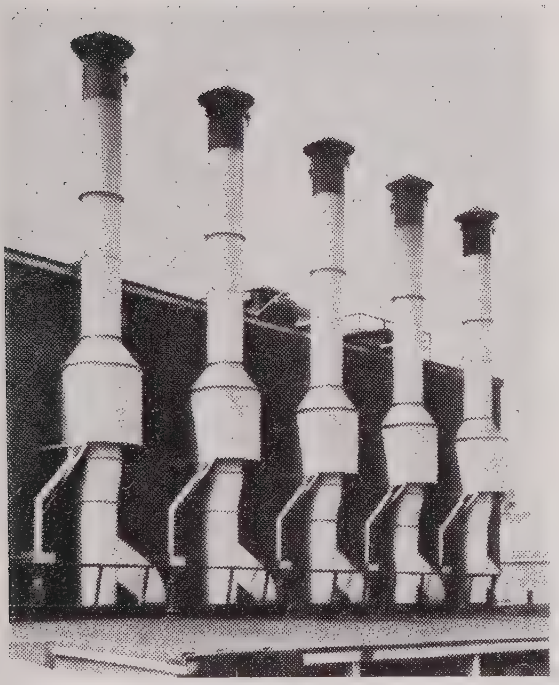
Radiation Group Sales Ltd., Park Foundry, Belper, near Derby.

Radiation

PARKRAY CONVECTORS
for comfort without smoke

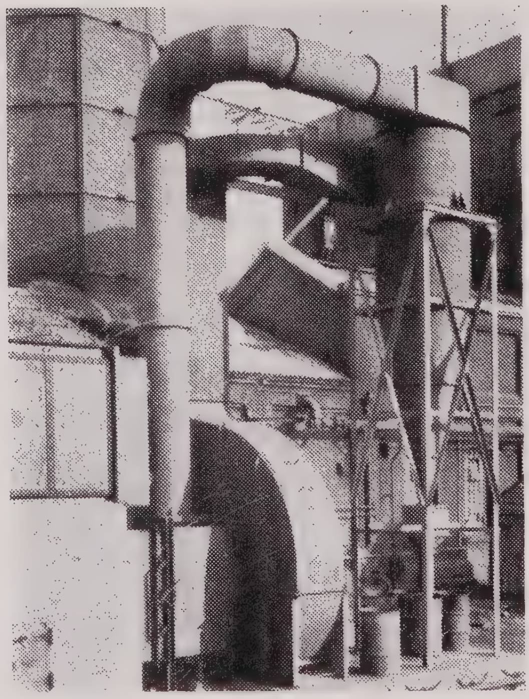
PRAT-DANIELS
(STROUD) LTD.

for
DUST
EXTRACTION
&
COLLECTION



Low Resistance Collectors

A complete range of dust collectors is available for boilers, furnaces, foundry cupolas and industrial processes.



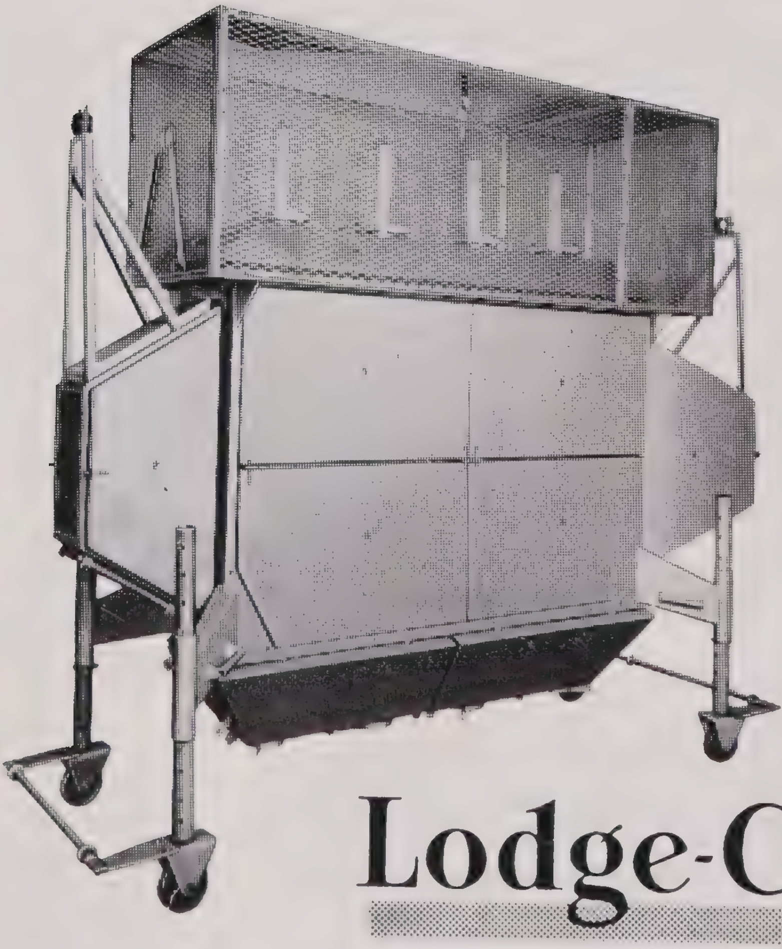
Turbo Collector

WHITECROFT, NAILSWORTH, GLOS.

LONDON OFFICE:
4 Westminster Palace Gardens, Artillery Row, S.W.1
ABBey 7661

ELECTRO FILTERS

of all types for the removal of any suspended particles from any gas stream



This small Lodge-Cottrell precipitation unit, size approx. 7 ft. high × 11 ft. long, is suitable for cleaning up to 1,000 cubic feet of gas a minute.

Lodge-Cottrell

LODGE-COTTRELL LTD. . GEORGE STREET PARADE . BIRMINGHAM 3
Telephone: CENtral 7714 (5 lines)
L.C.32

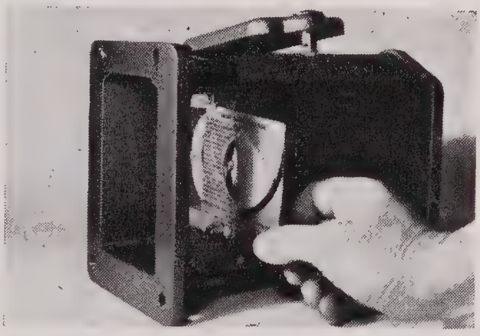
New Smoke Densitometer and Alarm complies fully with British Standards

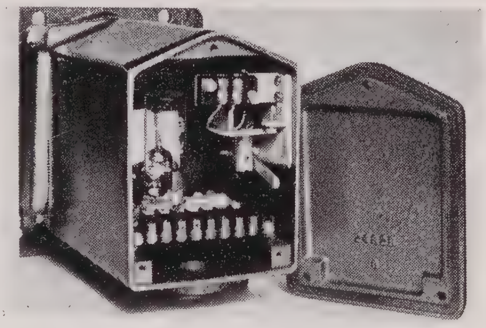
The Clean Air Act of 1956 calls for limitation of the emission of dark smoke (No. 2 Ringelmann or darker). This new Lancashire Dynamo smoke densitometer and alarm is not only an economical alarm unit which will ensure compliance with the Act but, by the addition of an indicator or recorder unit, it becomes a smoke desitometer for better combustion control and lower fuel costs.

This equipment is the first of its kind to carry the British Standards Institutions 'Kite Mark', which indicates independent certification of compliance with BS.2740/56 or, plus the appropriate indicating instrument. with BS.2811/57.

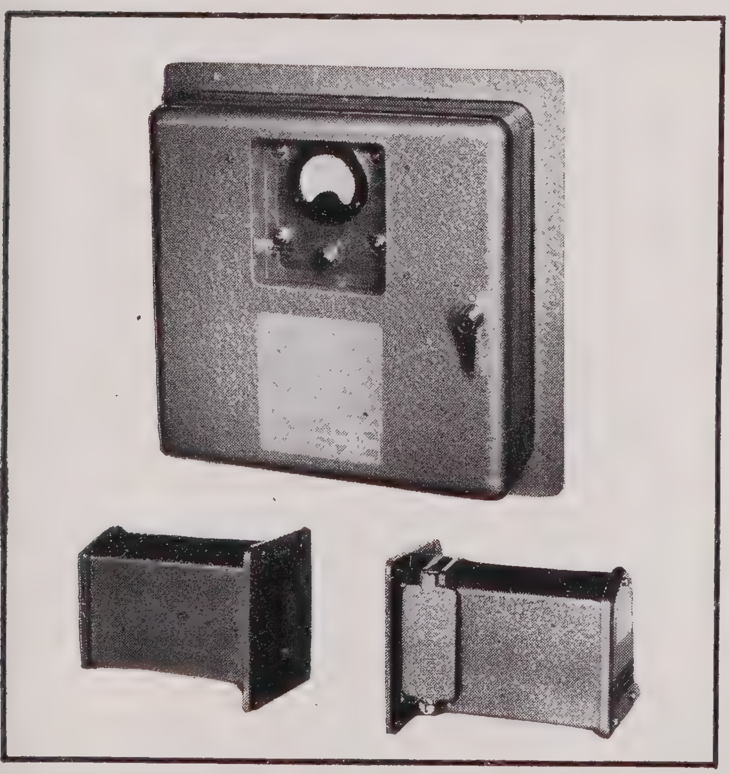
Note these Features

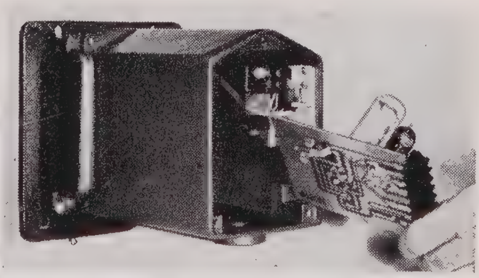
- **WEATHERPROOF CAST IRON HEAD UNITS WITH STAINLESS STEEL FITTING AND EASY ACCESS FOR LENS CLEANING.**
- **FULLY SERVO STABILISED LIGHT SOURCE PLUS "FAIL TO ALARM" CIRCUITS FOR CONSISTENT OPERATION.**
- **FULL RANGE OF ACCESSORIES INCLUDING CHIMNEY AND FLUE FITMENTS, INDICATORS, RECORDERS, ALARM BELLS AND HORNS, LENS CLEANING BLOWERS, SPECIAL CABLING AND MANY OTHERS.**

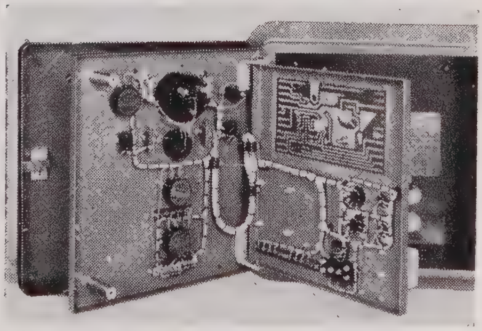




Calibration check by manual insertion of check slide or, in lower illustration of head with remote standardising unit, by push button from main unit.







Printed circuit in main unit and head for ruggedness. Head unit circuit easily removed without disturbing mounting of unit on stack.

LANCASHIRE DYNAMO ELECTRONIC PRODUCTS LTD

RUGELEY, STAFFORDSHIRE, ENGLAND

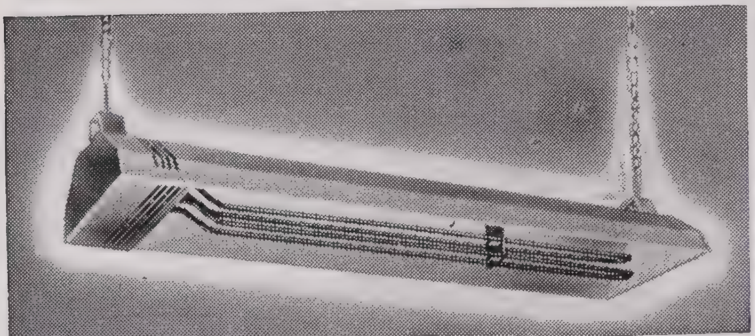
Manufacturers of Britain's widest range of industrial electronic equipment

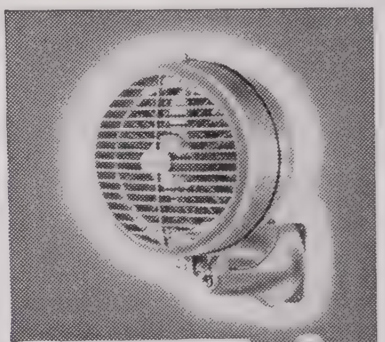
One of the Lancashire Dynamo Group of Companies

Every Heating Installation has its own problem

Which G.E.C. system is best for you?

The G.E.C. manufactures a full range of industrial electric space heating equipment, providing complete installation schemes to meet any type of individual requirement. A G.E.C. planned scheme means all-round economies — in layout, erection time and fuel consumption.



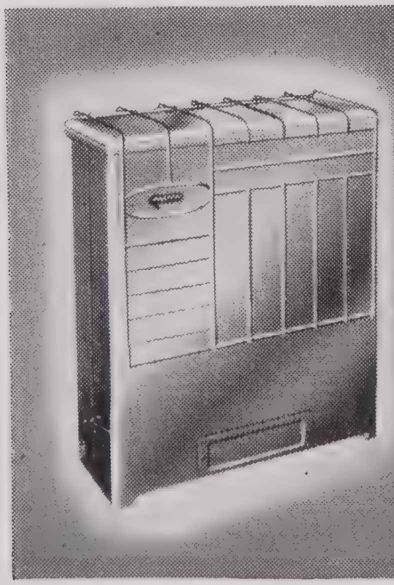


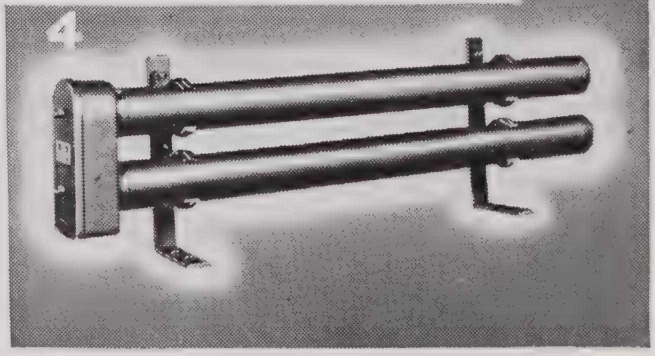
1 **OVERHEAD RADIANT HEATERS** - Provide warmth in situations where overall heating would be too costly. Create immediate warmth even with low air temperatures.

2 **NEW DESIGN NIGHTSTOR HEATERS** - Use electricity at night when special low cost off-peak tariffs are usually available. Cut electric heating costs considerably.

3 **UNIT FAN HEATERS** - From 3 kW to 20 kW for use in factories, shops, stores, halls and similar buildings.

4 **STANDARD TUBULAR HEATERS** - Available in various lengths up to 4-way banks. Flameproof models also supplied.





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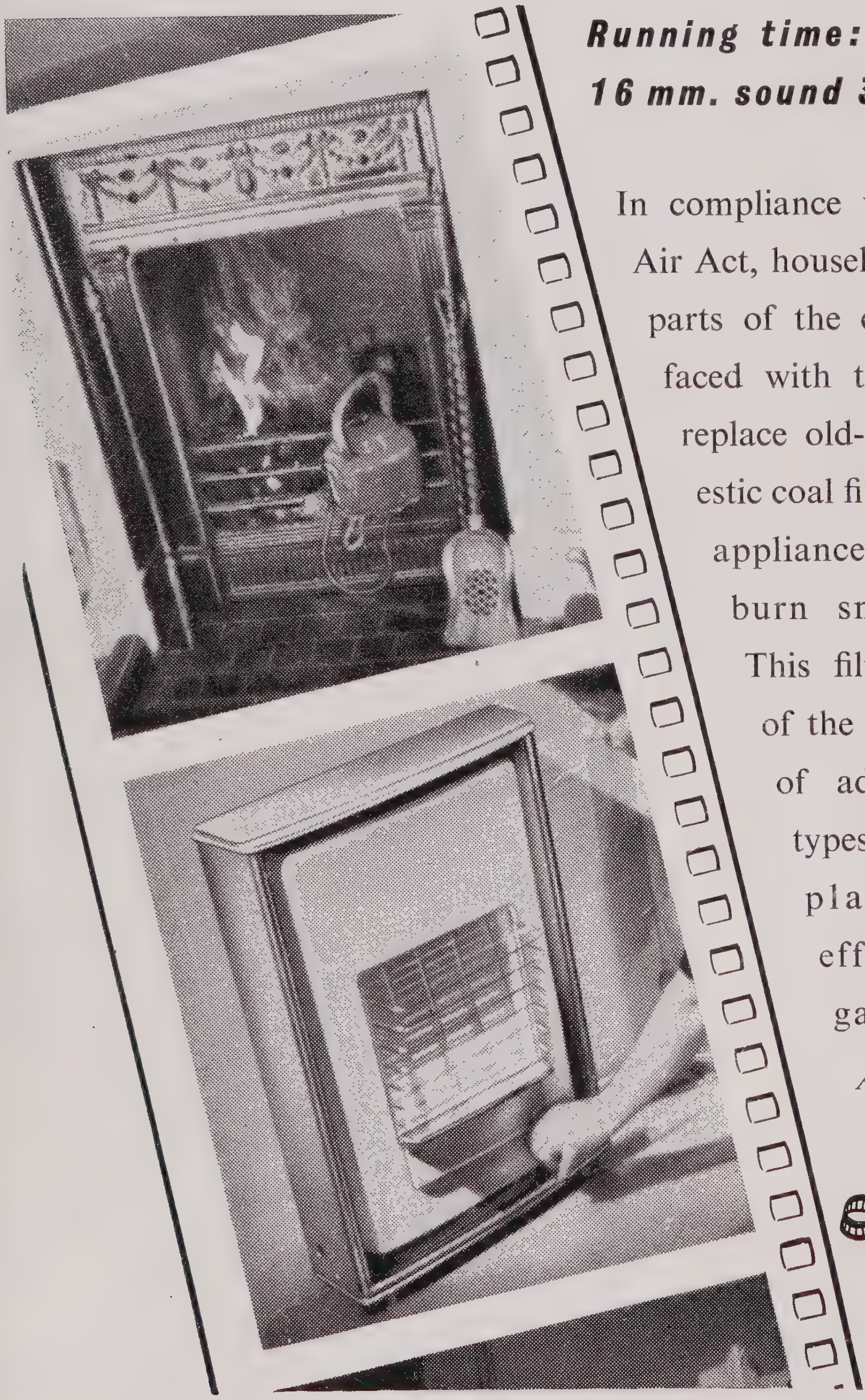
G.E.C. Industrial Electric Space Heating

THE GENERAL ELECTRIC CO. LTD., MAGNET HOUSE, KINGSWAY, LONDON, W.C.2.

The Clean Air Act: A New Film—

"SMOKELESS FUEL CONVERSIONS"



Running time: 10 minutes
16 mm. sound 35 mm. sound

In compliance with the Clean Air Act, householders in many parts of the country will be faced with the necessity to replace old-fashioned domestic coal fires with modern appliances designed to burn smokeless fuel. This film shows some of the simple methods of adapting various types of existing fireplaces for the efficient use of gas and coke.

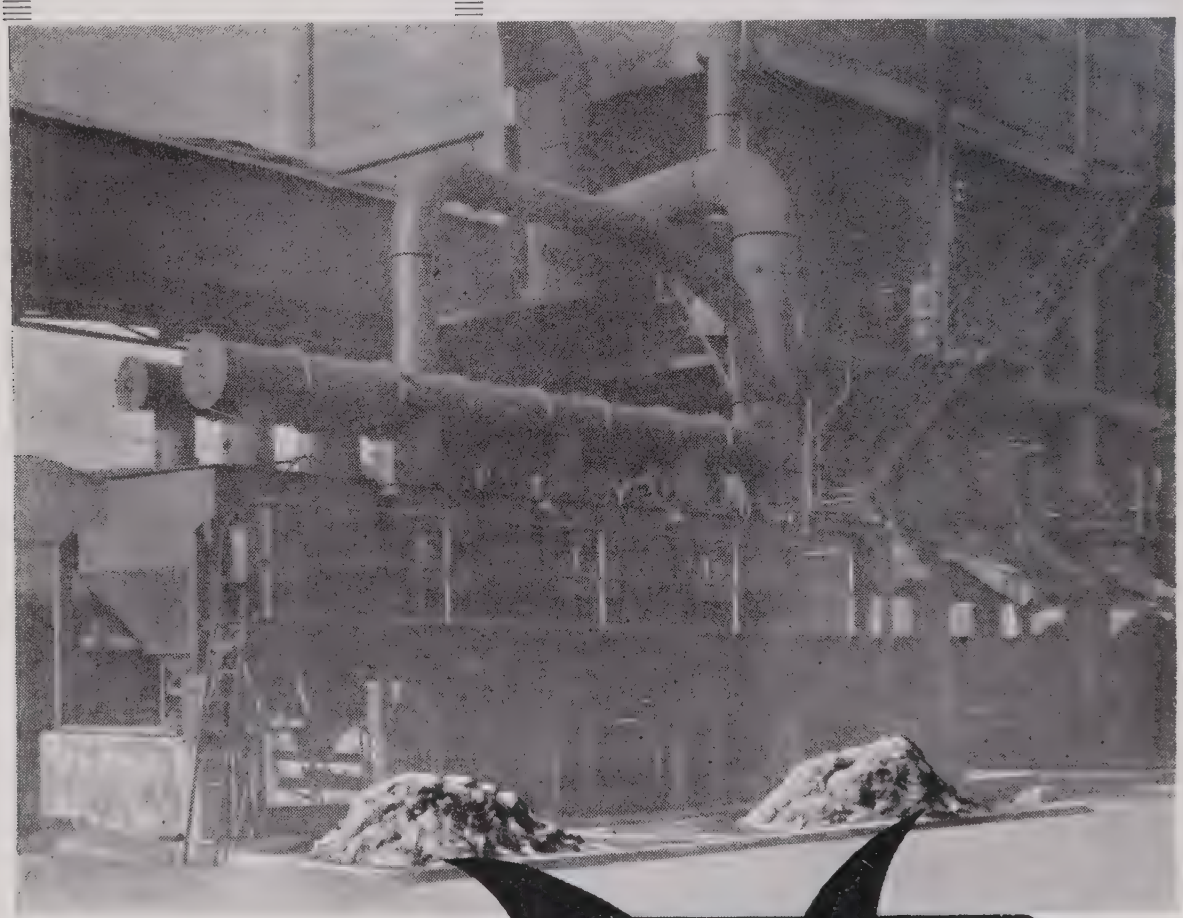
Available on free loan.

THE GAS COUNCIL (FILM LIBRARY) *1, Grosvenor Place, London, S.W.1*

DUST
&
FUME
EXTRACTION

DRUMMOND plants are satisfactorily dealing with dusts and fumes from boilers, furnaces, cupolas, converters, coke and coal handling, shot blasting, foundries, grinding, polishing, plating, paint manufacture and spray painting.

Large or small, if it is a dust or fume problem we can probably offer you a simple and robust solution that makes the very minimum demands for maintenance.



THESE HEAPS, each one a day's accumulation, represent a dense cloud of between ten and twenty million cubic feet of air.

We will gladly discuss your requirements with you

DRUMMOND PATENTS LTD.
5, Great Winchester Street, London, E.C.2
Telephone: London Wall 4432 & 2626
NORTHERN OFFICE: Market Chambers, New Market Street, Newcastle upon Tyne
Telephone: Newcastle 2-3837

Printed by The Leagrave Press Ltd, Luton and London

THE CLEAN AIR ACT and Fuel Efficiency

Have you taken ACTion yet? We offer priority to firms wishing to **abolish smoke emission** by the installation of mechanical stokers :-

UNDERFEED
"LOW RAM"
CHAIN GRATE

Application can be made for a government loan to purchase or we can supply on rental. Most mechanical stoker installations will pay for themselves in coal saving alone within the first one to two years.

JAMES HODGKINSON (SALFORD) LTD

Ford Lane Works, Pendleton,
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Tel: Pendleton 1491

Brettenham House, Lancaster Place,
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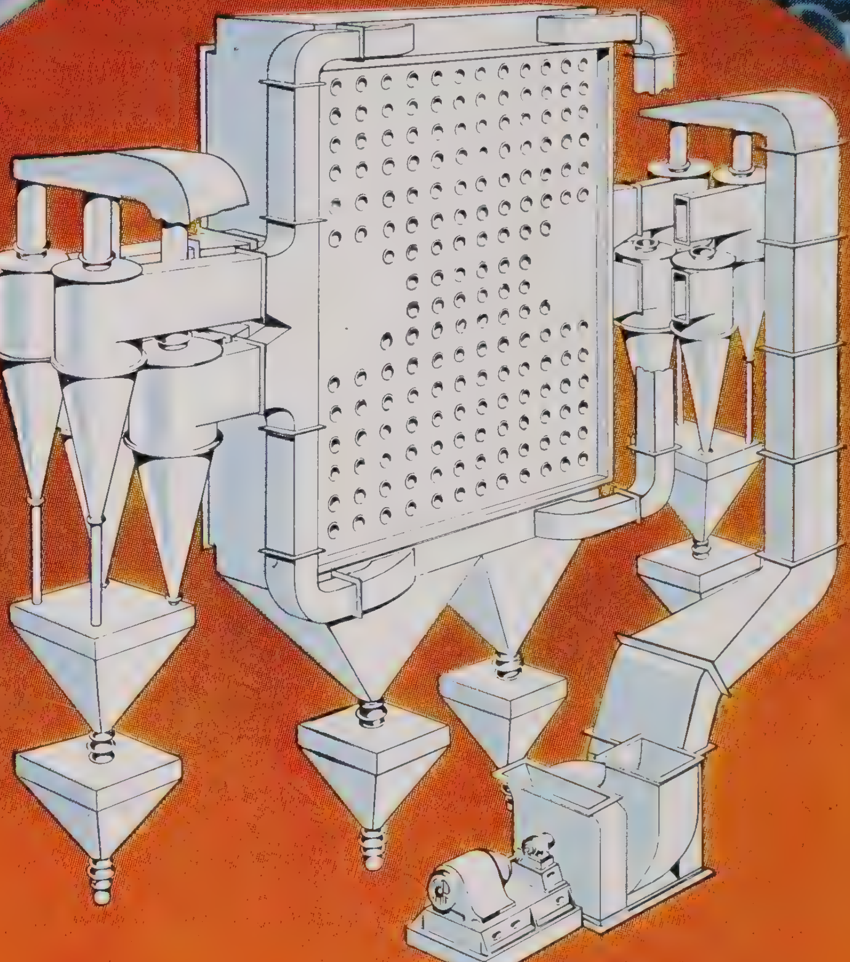
Tel: Covent Garden 2188

MULTI VORTEX DUST COLLECTORS



The Howden Multi-Vortex dust collector with cyclone secondary was specially developed to operate at collecting efficiencies of over 83%, and at a pressure drop of 1-in wg., to meet the exacting conditions called for in the steel industry today.

These collectors are specially suitable for installation on sinter plants, in front of our high-efficiency sinter fans, thereby ensuring long life to the fan wheel liners, and minimum atmospheric pollution.

HOWDEN

JAMES HOWDEN & COMPANY LIMITED, 195 SCOTLAND STREET,
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SMOKELESS AIR

JOURNAL OF THE
NATIONAL SOCIETY FOR CLEAN AIR

No. 109 ⋆ SPRING 1959 ⋆ 2/-

In this Issue

Smoke Control Areas—Minister's Circular and Progress Reports ★ The Coal Fire—N.S.C.A. Resolution ★ Technical Difficulties from the Clean Air Act ★ The Winter's Fogs ★ New Clean Air Posters ★ Smokeless Fuels Debate, etc., etc.

Why spoil it by burning raw coal?
Keep the air clean by using smokeless
fuels, either gas or a free-burning solid
smokeless fuel both of which can be
produced—smokelessly—in the
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Factory Equipment

Exhibition

including HEATING, VENTILATION
and INSULATION

Earls Court
London
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CLEAN AIR CONFERENCE

An important conference will be held at Earls Court on April 13th and 14th and will include the following sessions:

Monday, April 13th
(1) The Clean Air Act
(2) Smoke Prevention

Tuesday, April 14th
(1) Arresting Grit and Dust
(2) Planning New Plant and Factories in relation to the Act.

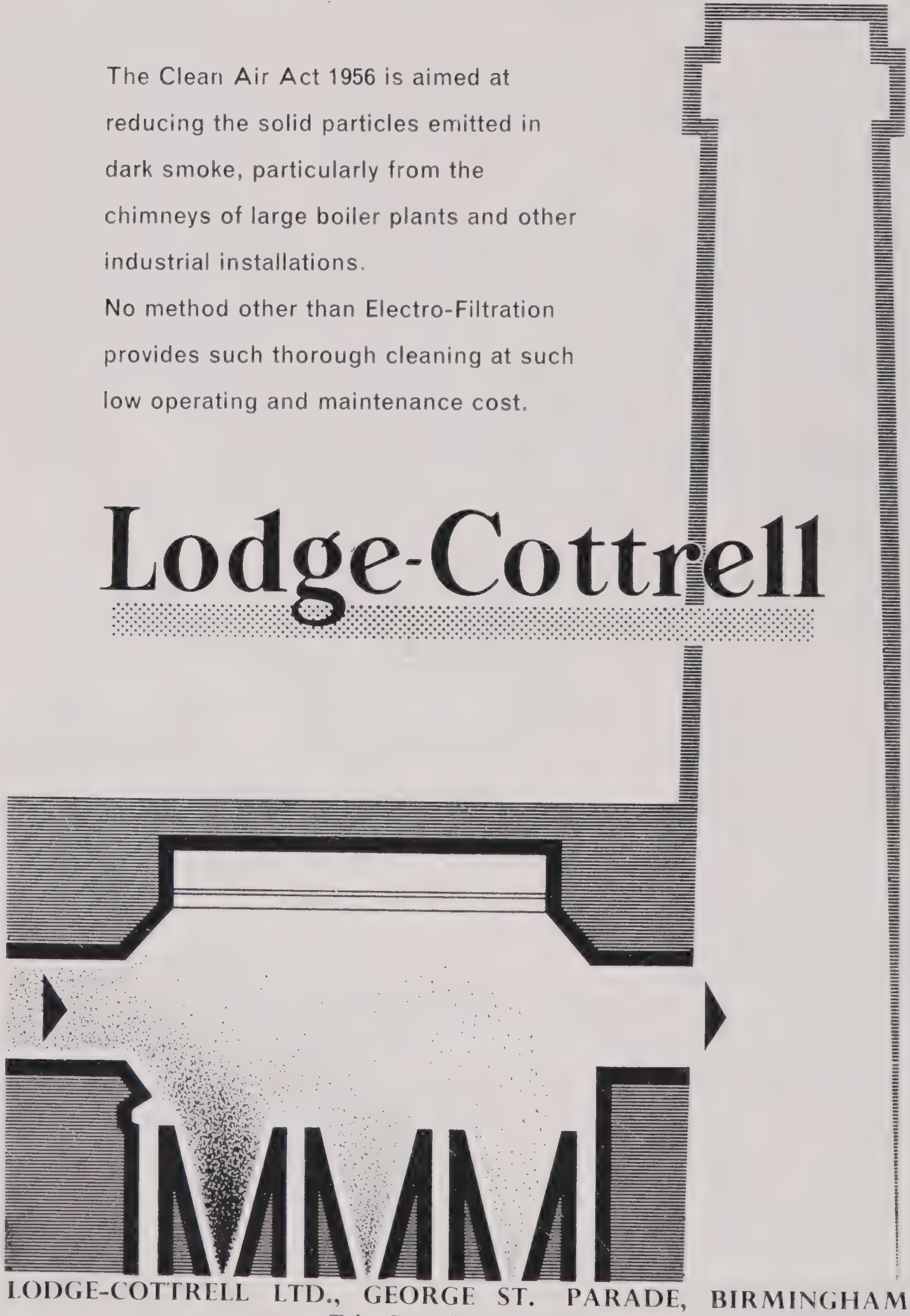
Details from The Conference Organiser,
4 Snow Hill, London, E.C.1

Exhibition open Daily 10 a.m. – 7 p.m. (except Sunday)
Closes Friday 17th at 4 p.m.   Adm. 2/6

pioneers of electro-filtration

The Clean Air Act 1956 is aimed at reducing the solid particles emitted in dark smoke, particularly from the chimneys of large boiler plants and other industrial installations.
No method other than Electro-Filtration provides such thorough cleaning at such low operating and maintenance cost.

Lodge-Cottrell



LODGE-COTTRELL LTD., GEORGE ST. PARADE, BIRMINGHAM 3
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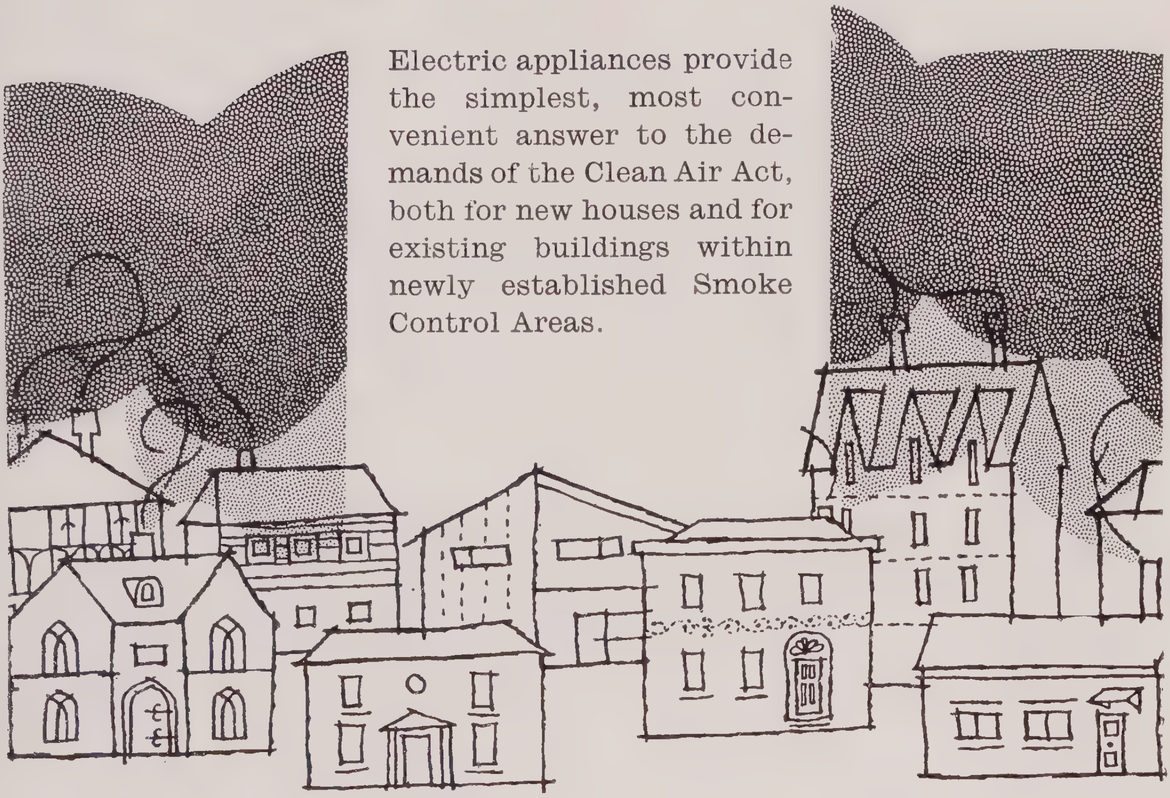
SOUTH AFRICA: Branch Office: 75 Magor House, 74 Fox Street, Johannesburg.
AUSTRALASIA: F. S. Wright, 465 Collins Street, Melbourne, Australia

L.C. 34

'Clean Air' is no problem with electricity

Electric appliances provide the simplest, most convenient answer to the demands of the Clean Air Act, both for new houses and for existing buildings within newly established Smoke Control Areas.



Electricity is completely smokeless

Electric water heaters are so clean in use
that they bring big savings in redecoration
costs; electric floor warming is cheap to install
in new buildings under construction,
since it needs no chimneys, pipes or radiators, and
is very popular with the occupants. And
both electric water heating and
space heating are remarkably cheap to run.

The modern way of heating is electric

Issued by the British Electrical Development Association, 2 Savoy Hill, London, W.C.2.

Smoke

vanishes

into

thin air

The Godber Smoke Burner will do the following:

1. Remove all fear of complaints from the Smoke Inspector under the Clean Air Act.
2. Give a working efficiency and a coal saving that will repay its costs in a few months.
3. Work automatically with boiler draught without "repair or renewal."

The cost (including fitting) for a *Lancashire Boiler is well under £300 and we fit on a basis of "no cure–no pay."

SMOKE BURNERS LTD.

130 Baslow Road, Totley Rise, Sheffield.
Registered Office: Park Foundry, 64 Park Road, Chesterfield. Telephone: Chesterfield 2824.

*Can be fitted to handfired, automatic sprinkler or shovel stoker.

'COALITE'
REGISTERED TRADE MARK
SMOKELESS COAL

The perfect fuel for
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Please order well in
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requirements.

COALITE AND CHEMICAL
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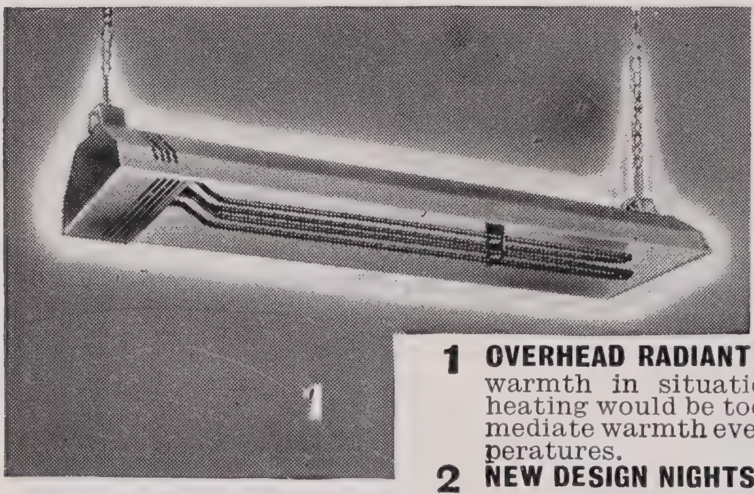
Clean Air with

G.E.C.

Electric Space Heating

The G.E.C. manufactures a full range of industrial electric space heating equipment. A G.E.C. planned scheme means all-round economies—in layout, erection time and fuel consumption.



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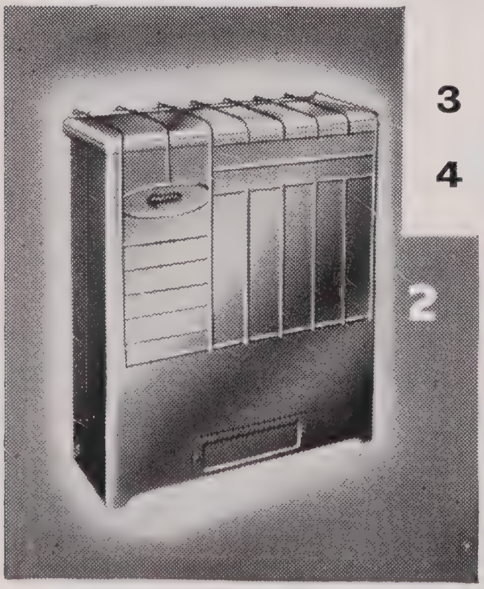

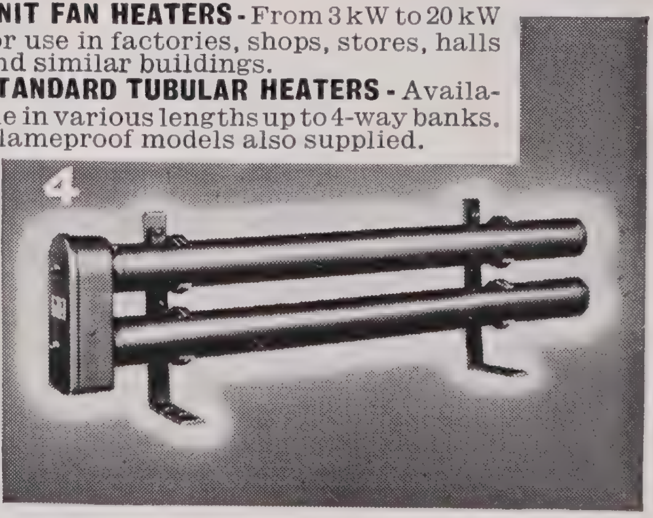

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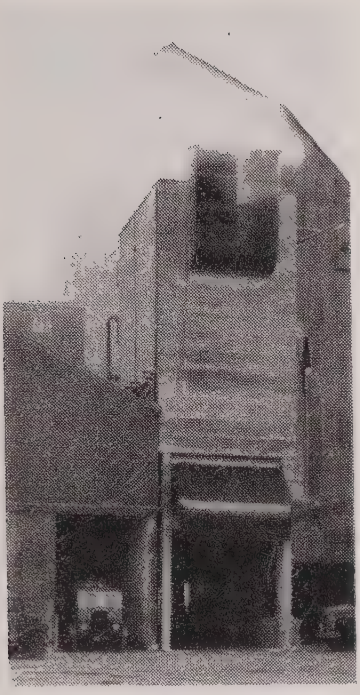
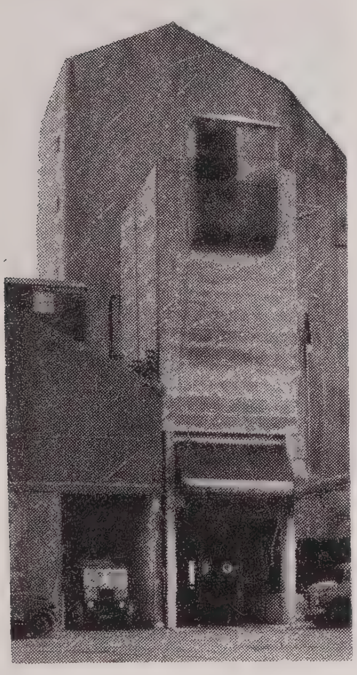
G.E.C. **Industrial Electric Space Heating**

THE GENERAL ELECTRIC CO. LTD., MAGNET HOUSE, KINGSWAY, LONDON, ,W.C.2.





Dust
emission
prevented
by
a

STURTEVANT

ELECTROSTATIC PRECIPITATOR

The high efficiency dust collection from a Limestone Drying plant by this Sturtevant Precipitator prevents a heavy dust discharge to atmosphere.

Sturtevant Precipitators are collecting:

Metallic Oxides
Aluminium Silicate
Selenium Fumes
Boiler Flue Dust
Precious Metals
Asbestos
Sugar
Acid Mist
Pyrites
Chalk
Coal Dust
Ceramic Dust
Limestone
Phosphate Dust
Cement Dust
Carbon and Carbon Black

A copy of the 11th edition of our publication M.7009 dealing with Sturtevant Electrostatic Precipitation may be obtained upon request.

STURTEVANT ENGINEERING CO. LTD.
Southern House, Cannon Street, LONDON, E. C. 4.

AUSTRALIA: STURTEVANT ENGINEERING CO. (AUSTRALASIA) LTD. 400 SUSSEX STREET SYDNEY N.S.W

New Edition available

at low cost

QUANTITIES TO MEET ANY REQUIREMENTS

Contents include:

- Main provisions of the Clean Air Act 1956.
- Implementation of the requirements.
- The Authorised Fuels.
- Modifications and Replacements. (*with a full range of illustrated examples giving estimated COSTS*)

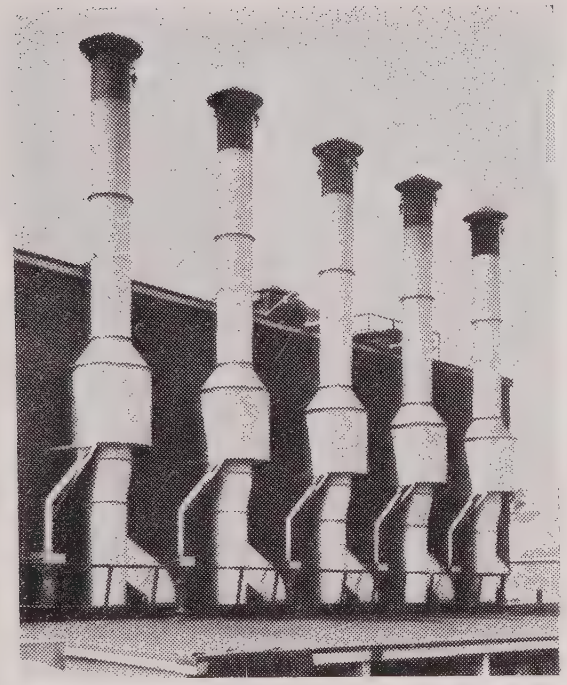
Following the great demand for "Clean Air for You"—three editions of this authoritative publication have already been printed—it has been decided to print a low cost edition suitable for general distribution by Local Authorities. Specimen copies and terms for supplies can be obtained on application to the Solid Smokeless Fuels Federation.

S.31

SOLID SMOKELESS FUELS FEDERATION · 74 Grosvenor Street, London, W.1.

PRAT-DANIELS

(STROUD) LTD.



Low Resistance Collectors

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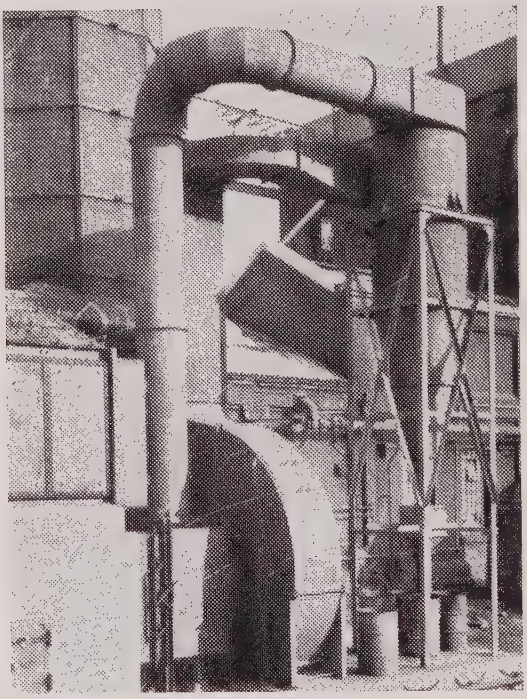

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SMOKELESS AIR

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Ships, towers, domes, theatres and temples lie
Open unto the fields, and to the sky;
All bright and glittering in the smokeless air.

SMOKELESS AIR

Smog Again

THE winter that is just passing has been marked by many periods of foggy weather, affecting large areas of the country, and often persisting and turning to smog. The Clyde and Forth valleys, Liverpool, Manchester and Salford appear to be the areas most affected, with London this time suffering to a lesser degree. At the time of writing there is little information on whether these conditions have led to any increases in mortality and morbidity, but to judge from some of the reports of emergency hospital arrangements for bronchial patients, the evacuation of such patients from Glasgow, and the rushing in of oxygen supplies, it will be surprising if the records do not show once more the familiar sad rise in sickness and death. Some first accounts of the fogs are given in this issue, together with a very useful report, from the *Manchester Guardian*, on one of the aspects of fog that it is always difficult to assess—the cost.

The issue by the Ministry of Housing and Local Government of a circular to local authorities on smoke control areas, is in effect a firm reminder that they should get a move on with their plans. It could not have been better timed. Especially useful is the Minister's emphasis on the seriousness of the pollution from the domestic coal fire. Again, the timing of the Minister's memorandum could not have been more helpful in relation to the deplorable publicity campaign to encourage the coal fire. This is discussed in more detail, with a resolution from the Society's Executive Council, in an article on another page.

Other news concerning the guilt of the coal fire is included in this issue—namely, the account of the investigation by Dr. Percy Stocks into air pollution in relation to bronchitis and cancer, and the findings of D. H. Lucas on pollution caused by large numbers of open coal fires emitting smoke at a low level. On the other hand there is a report of potentially important advances in smokeless fuel production from the Stoke Orchard Research Establishment of the National Coal Board.

Smokeless Fuel Supplies

There has been a great deal of talk, some complaint, and some propaganda from certain quarters, about the supply position of smokeless solid fuels during the winter, especially with respect to the so-called " premium " fuels—the free-burning manufactured fuels. The best way of giving an account of the position seems to be to report a recent debate and some questions and answers about it in the House of Commons. It is interesting to note that the greater attention being given to clean air is resulting in an increasing demand for smokeless fuels in areas that are not yet smoke controlled. This may be making it more difficult for the time being to supply some of the smoke control areas with the most favoured fuels, but it must be borne in mind that most of the demand must come from the other parts of the black areas, which will themselves become smoke controlled in due course.

That difficulties would arise in supplying smokeless fuels as the smoke control area policy began to gather momentum was to be expected. That difficulties may be arising already means that steps will have to be taken to deal with them sooner rather than later—by increasing smokeless fuel production capacity, pressing on more urgently with new processes, and helping to speed up the steady trends towards a greater use of electricity, gas and oil for domestic heating. To argue that because things are or may become difficult progress in creating smokeless zones or control areas should be slowed down, is the surest way of ensuring that the necessary changes and developments will *not* happen. To press on, so that there is a more pronounced clamour for smokeless fuels, may mean that smoke control proposals will have to queue for approval, and may well cause headaches in some quarters. But it is the only way of achieving the programme that the Beaver Committee, after the most careful consideration, agreed was both desirable and possible.

Smokeless Homes are Safer

An important secondary advantage of using smokeless fuels in the home instead of coal was emphasized recently by Chief Officer Frank Hilton of the Nottingham City Fire Brigade. In an article in the *Nottingham Evening Post* he wrote that in the city there had been an average of 510 chimney fires every year for the past ten years. The danger is that the burning soot, besides sending embers over roofs and through open windows, often falls with a gush down the chimney and ignites floor coverings, furniture and other inflammable articles.

Frequent cleaning of chimneys reduces the risk, but pockets of soot tend to collect in some chimneys. Smokeless fuels, says Mr. Hilton, are a great help in preventing soot accumulations and should be used where possible. Then comes an important and significant piece of information:

" It is interesting to note that since the building of the Clifton Estate and its scheduling as a smokeless zone, which covers a period of seven years, the Fire Brigade has not recorded any chimney fires having occurred on the estate. This fact is very enlightening and one has not to look very far to find the moral."

Posters

The national open Poster Design competition organized by the Society and the *News Chronicle* proved to be successful in every way. Many readers will have seen the excellent special clean air supplement in the newspaper, in which the winning designs were reproduced for the purposes of a voting competition among its readers. That in itself was first-class publicity for clean air, and the posters have given the Society a fine choice of new designs and ideas. Over 1,500 entry forms for the poster competition were sent out by the Society, and over a third of these came back with a poster. It was not an easy task for the three judges—Mrs. Grace Lovat Fraser, of Schweppes, Ltd., Sir Hugh Beaver, and Mr. Norman Cursley, Editor of the *News Chronicle*—to arrive at their final decision and award the eight prizes.

The first prize winner (£100) was Miss Stella Harvey, a free-lance commercial artist of Bexleyheath, and the second prize went to Eric J. Buthom, another commercial artist, whose entry came from Germany, where he is stationed while on National Service.

From the winning and other leading designs the Society's Publicity Committee has selected five for immediate printing. The printing of coloured posters is quite expensive and the Society could not risk the outlay if there was not confidence that there would be a steady sale of them to local authorities and others. As indicated on another page the prices at which they are being offered are very moderate. It will be seen that the size of the prints will be 30 inches by 20 inches, but we are anxious to learn if there is a demand for a smaller size (e.g., 20 by 15 inches), or even for miniatures and stick-on labels. The possibilities of printing in special shapes and sizes for use on buses, etc., is also being considered. It would be most helpful to have the views and suggestions of readers who are interested in using posters for their clean air publicity.

The Diamond Jubilee Conference

At this stage there is not a great deal more to report on the Society's International Conference to be held in London in October next. Attention has been given primarily so far to making the event known overseas. Over 500 invitations have been sent out, with personal letters, to all kinds of likely organizations in numerous countries, and it is clear that there is much real interest. Publicity overseas includes a poster about the conference that is being displayed in all British Council centres throughout the world. Invitations to participate in the Exhibition have gone out—to members of the Society and advertisers in this journal—and it was gratifying that over half the stands should have been booked within a week.

Notices and invitations to local authorities, other bodies and firms in this country are now being prepared and will be sent out in the usual way during May, or earlier. Registrations may of course be made immediately, by simply writing in.

Honours

We offer our congratulations to members and friends of the Society who were honoured by Her Majesty in the New Year Honours list. Mr. T. C. Finlayson, a Vice-President, of the Woodall-Duckham Construction Co. Ltd. (one of our Sustaining Members), becomes a Companion of the Order of the British Empire; Mrs. D. Charlton, a member of the Executive Council, representing the Women's Advisory Council on Solid Fuel, becomes an Officer of that Order, and Mr. John Graham, Chief Public Health Inspector, Manchester (his paper to the Society's Bournemouth conference will be recalled) is awarded the M.B.E. Congratulations also to our Hon. Treasurer, Mr. Stanley Cohen, and to Mr. G. B. Courtier of the London County Council (who read a paper on radioactive pollution at the last conference) on being elected to Fellowship of the Royal Society of Health.

Up in the Air

The Lord Mayor of London, at a recent dinner, read a friendly letter he had received from the civic head of a township overseas. It ran as follows:

" Dear Brother Mayor — Friday evening my radio reported that you are having a terrible time with Fog all over the City. A plan I have, if you could have a *tower* up above the buildings with an *electric fan* on the top of it, I think it would cause some sucksion. If the electric fan was worth while you would want one in different parts of the City to get a good circulation.

" Another plan I have is, if you could have a balloon with an electric fan fastened to the bottom of the basket, and a rope of the balloon so you could hold it where you wished to at any height, and pull it back any time you wanted to. I wanted to mention the ideas I had to you, so if you will forgive me for butting in, I will remain your distant Friend, wishing you good luck and some good air to breathe."

Similarly seeking to be helpful, the following brief note came recently to one of our members in a local authority:

" Gentlemen—I have a power jet Flame that makes the winds Blow. This Cleans away all the Fog and Smoke and Leaves your City full of Puer Air.—Yours, etc."

First Smokeless City ?

Bradford, pioneer in so many social services, may well be the first city in the country to became completely smoke-free.

With the progress Bradford has already made in establishing smokeless zones, and with the plans for the future already well in hand, it has such a lead on other authorities that even normal progress will bring the distinction.—*Telegraph and Argus, Bradford.*

The Raw Coal Fire

An N.S.C.A. Resolution

IT may amaze some future historian of air pollution that six years after the most deadly smog of all, the Executive Council of the National Society for Clean Air should find itself obliged to adopt the following resolution:

"THAT this meeting of the Executive Council notes with surprise and regret the appearance of advertisements on behalf of the domestic raw coal fire. This major cause of air pollution was condemned by the Government Committee on Air Pollution (the Beaver Committee), the recommendations of which were accepted by Parliament and embodied in the Clean Air Act. To encourage the coal fire cannot but render more difficult the transition to smokeless methods of domestic heating (including smokeless open fires) and the extension of smoke control areas, and is thus contrary to a policy decided by Parliament to be in the national interest.

"The Council are further of the opinion that such advertising is contrary to the best interest of the coal industry, the future prosperity of which, so far as domestic usage is concerned, must be based on raising the economic value of coal by processes that among other things will provide smokeless fuels of greater efficiency and cleanliness than coal in its raw state."

One or more of the advertisements referred to will have been seen by most of our readers. The theme of the one which prompted the resolution was simply that there is nothing so cosy as a nice coal fire. Unable to advocate the coal fire on grounds of efficiency, cleanliness, convenience, labour-saving or other real merits, the advertisement had perforce to rely plaintively on an appeal that belongs to a past era. The indignation of those in the movement for clean air would possibly have been lessened if there had been any reference to the solid smokeless fuels or to the fact that the advertisement could not apply to those living in smoke control areas.

The misguidedness of this campaign has been sharpened by its beginning in a season of exceptionally widespread fog, with official broadcast warnings of smog and appeals not to burn raw coal. It was a curious but gratifying coincidence, too, that immediately after the first advertisements appeared in the national press the Minister of Housing should, as reported on another page, have urged local authorities to press on more quickly with their smoke control area plans, and that he should have referred specifically to the dangers of low-level household smoke. Another ironical coincidence is that the publicity should begin at a time when failures in domestic coal distribution were giving rise to widespread discomfort and protests. How many consumers, we wonder, decided in exasperation to switch over to electricity or gas, or to buy another oil heater. Confidence in the delivery of fuel, especially when the weather is cold, gives a sense of security that counts a great deal.

The advertisements are being issued by the Coal Utilization Council, and are being paid for by an extra levy on the coal merchants of 2d. per ton of coal sold. The C.U.C., to quote from a speech by its President, has been given an increased budget of from £100,000 to £300,000, out of which it is proposed to spend £100,000 on national press advertising, £50,000 on commercial television, and £41,000 on local advertising.

In the decade before the last war, when the smoke abatement movement was gathering strength, the coal trade was open in its opposition, as this Society's records can show. Since the war, following the reports of the Egerton, Simon, Ridley and Beaver Committees, there has been—with a few commendable exceptions—what was thought to be a cool and grudging acceptance of the clean air case and policy. But since the Clean Air Act has come and has put teeth into that policy there have been plenty of signs of half-concealed opposition, or of the neutrality that is akin to the faint praise that damns.

Here, for instance, is a quotation from Mr. J. Stanleigh Turner, President of the Coal Utilization Council, speaking at a recent luncheon of the Coal Industry Society:

> " We now have to combat the feeling of guilt in putting the extra lump of coal on the fire and educate the younger generation on the comfort, health and desirability of burning coal properly on proper coal fires, properly installed.
>
> " The C.U.C. will neither promote nor oppose clean air campaigns, but will devote itself to informing people, when a smokeless zone is declared, that solid fuel can be burned satisfactorily."

And, more clearly still, Mr. F. C. Dobson, president of the Coal Merchants' Federation of Great Britain, in an article in *The Coal Merchant and Shipper* (3rd January, 1959):

> " Let me turn to clean air. Nearly everyone subscribes to the general intentions underlying the Clean Air Act and its object is certainly one which deserves every support and encouragement. In industry the Act requires, broadly speaking, that everything reasonably practicable should be done to abate air pollution, having regard to cost and the maintenance of industrial production. Dark smoke is prohibited. All this is very commendable because by far the greater proportion of the bituminous coal produced is consumed by power stations, coke ovens, gasworks, iron and steel works, and hundreds of other industrial furnaces. Greater consideration should be given, therefore, to the possibility that it is the smoke, grit, dust and gases emitted from these industrial installations which are mainly responsible for air pollution and harmful elements in fogs in industrial areas.
>
> " Unfortunately, publicity about the Act tends to be concentrated on the provisions for dealing with domestic smoke. Consequently there is a strong tendency for local authorities to apply for smoke control orders regardless of consequences or real necessity.
>
> " Since the Beaver Report, upon which the Clean Air Act was based, a big change has taken place in the coal situation and there are a number of reasons for a careful re-assessment of the policy regarding smoke control orders. There should be reflection upon the proper balance between the need for cleaner air and other important considerations.
>
> " It is well to bear in mind that the Government, if it had thought fit, could have included in the Act a comprehensive, compulsory smokelessness all over the country concerning domestic chimneys, but in its wisdom it allowed the choice of the imposition of a smoke control order to lie in the hands of the citizens of every area, albeit through their local authority officers, who are are their representatives and servants.
>
> " The Federation, naturally, as a responsible body, cannot and does not wish to oppose clean air or the Act, but, having taken stock of the situation, has recommended that all members should pay an extra 2d. per ton levy to the Coal Utilization Council, purely for the promotion of domestic coal and the open fire. The N.C.B., too, has increased its contribution.
>
> " Never before have we had ahead of us a publicity campaign on such a scale for the open coal fire. Let us hope it can turn the scales weighted against us by its absence in the past."

This statement is well worth careful re-reading—and especially between the lines.

The second part of the Society's resolution, expressing the view that to seek to popularize the open coal fire is not in the best interests of the coal industry, raises matters of serious national importance. We are in the middle of a profound revolution in domestic heating methods, habits and traditions, a revolution in which new demands and new standards call for new methods and for the sources of heat and power that can best serve them. This revolution is largely independent of the policy for clean air, although happily the two closely coincide and reinforce each other. Solid fuel can continue to play an important part if it is able to meet and compete with, on grounds of efficiency, cleanliness and security, the newer and more controllable forms of fuel and power. Although in the end solid fuel may cease to be used in the home, this may be a distant prospect. The surest way of bringing it nearer is to refuse to recognize the revolution that is occurring and to base the values of solid fuel on flickering flames, cosiness and all that.

Like Mrs. Partington's effort against the Atlantic, if this campaign has any success at all it can be but transient, and it is not likely to alter the pattern or progress of change. The clean air movement may well benefit from the stimulus of a little opposition, and from the knowledge that the neutralism of the coal trade is of the kind of which it has been said:

Thou shalt not kill; but need not strive,
Officiously to keep alive.

Does the Clean Air Act Discriminate against Coal?

In a debate on fuel and power policy in the House of Commons, on 6th February, 1959, Mr. William Blyton (Houghton-le-Spring) in a speech urging a new fuel policy, said that the Government seemed to have declared war on coal. Following is an extract from his speech, with interventions:

Mr. Blyton: Now I come to clean air. The Clean Air Act was another example of deliberate discrimination against coal. Oil-fired furnaces have been granted exemption by order from the operation of the smoke controlled areas, but that exemption is not granted to mechanical stokers using solid fuel.

Mr. Nabarro: Will the hon. Gentleman permit me to interrupt? It has been said over and over again in this House by spokesmen on both sides that the use of chain grate mechanical stokers enables even the lowest grade of coal to be used smokelessly. There is nothing at all in the Regulations made under the Clean Air Act which discriminates against the use of coal in industry, provided that the coal is efficiently burned, and if it is so efficiently burned it will be burned smokelessly.

Mr. Blyton: I am sorry to tell the hon. Gentleman the Member for Kidderminster (Mr. Nabarro) that great pressure is now being brought to bear on the Minister by the boards of the nationalized industries to try to get an order of the kind I am seeking here today. The coal industry is subject to the decisions of a local authority, whereas oil-fired furnaces are exempted by order presented to this House by the Minister of Housing and Local Government.

Why this discrimination? What crime has coal committed that it should be discriminated against like this? It means that buildings now planned and industries in smoke control areas are being forced to take oil instead of coal, and this still further reduces our ability to sell coal. It is most unfair. I ask that the Government should end this discrimination against coal and coal users by introducing an order, as was done in the case of oil, to grant exemption from the provisions of the smoke controlled areas regulations to furnaces fired by mechanical stokers. The Minister of Housing and Local Government introduced the order to help the oil industry. Why should not similar action be taken on behalf of the coal industry. The hon. Member for Kidderminster may not like this, but it is a fact.

Mr. Nabarro: It is absolute nonsense.

Mr. Blyton: There is general agreement among fuel technologists that if coal-fired mechanical equipment is properly installed, operated and maintained there will be no significant smoke emission.

Mr. Nabarro: That is just what I have told the hon. Member.

It must be said that Mr. Blyton's argument is somewhat misleading. The only oil-fired equipment that has been approved by Order for use in smoke control areas, under Section 11 of the Clean Air Act, is that under 55,000 B.Th.U. per hour capacity—that is the smaller domestic type heaters and central heating boilers. It was introduced because of the apparent discrimination against oil in not being included among the approved fuels, proof of the use of which is a defence in a case of smoke emission in a smoke control area. With larger plant coal and oil are in exactly the same position, neither being an approved fuel.

Any discrimination could arise only locally, where exemption against the provisions of a specific smoke control order (which means in effect a licence to produce some smoke) may be granted, under conditions, in respect of an individual installation. It does appear that some local authorities are tending to grant such exemptions to oil-fired plant (perhaps because they have confidence that the amount of smoke likely to be emitted will be negligible) and are being reluctant to do the same for certain coal-fired plant (perhaps because they have not the necessary confidence). On the other hand, many authorities are exempting approved types of mechanically-stoked coal-fired plant. Mr. J. W. Dickie, Technical Officer of the Federation of British Industries, in his recent paper to the Royal Society of Health, appeared to be satisfied with the way things were developing. He said:

> " Manufacturers of solid fuel-firing equipment have expressed understandable concern, lest the use of bituminous coal should be completely banned in smoke control areas. It is generally accepted that modern mechanical stokers can operate normally without the emission of smoke, and it is evident that local authorities share this view, since those orders so far confirmed make provision for their use under specified conditions. These stokers, which are in common use for heating commercial premises, should be encouraged in the interests of fuel conservation."

And, we might add, for the freeing of smokeless fuels for domestic use.

M.G. Comment

We cannot conclude this note better than by quoting the angry comment of the *Manchester Guardian*, which we know will be appreciated, on the attempt to blame the Clean Air Act for the coal production situation:

> ' Most of the country has just endured some of the worst fogs for several years. Hospitals have been crowded with pitiful cases of bronchitic patients, choking with pain because of the filth that national failure to use fuel sensibly has compelled them to breathe. Yet there were times in the debate on fuel policy in the Commons yesterday when it seemed that Parliament was being urged to legislate for more fogs. Mr. W. R. Blyton, Labour Member for Houghton-le-Spring, carried his sense of outrage about stocks of unsold coal to a point at which he declared that the Clean Air Act was " discrimination " against coal and that such " discrimination " ought to be " abolished." Wasting more tens of thousands of tons of coal by pouring it into the air as unburned smoke (at a cost of £6 or £7 a ton) might help to keep some uneconomic pits going, but it would not help the community, or, in the long run, coal itself. Why did not the Opposition use yesterday's debate to attack the Government for its contribution to blacker and better fogs by the idiocy of purchase-tax regulations which at present deny householders the use of one of the most efficient and most economical forms of heating? . . . '

The leader continues by discussing this form of heating, on which a detailed explanation was also published, namely the electrical storage block heater. The absurd situation has been mentioned in the past in *Smokeless Air* and it still remains. That is, these heaters, which use off-peak current, are only available to industry and commerce without purchase tax on condition that none are sold for domestic use. If they were, purchase tax would be clapped on the heaters, no matter to whom they were sold. Apart from its value as a form of smokeless heating, the greater use of this method of helping power stations to keep running at night would help to reduce the embarrassing stocks of small coal.

SMOKE CONTROL AREAS–MINISTER'S CIRCULAR

Faster Progress Urged

In consultation with the Clean Air Council the Minister of Housing and Local Government has sent a circular (No. 5/59) to Local Authorities in England and Wales on the rate of progress being made and expected in the establishment of smoke control areas. The circular stresses the importance of dealing with household smoke:

> About half the smoke in the atmosphere comes from domestic stoves and fireplaces burning coal. Most of it is discharged at low level. Normally it is not dark smoke, and is therefore not covered by section 1 of the Act; smoke control orders under section 11 are the means provided by the Act for dealing with it.

After reviewing the progress so far made (the latest returns on which are given in this issue) the Minister continues:

> This is an encouraging first response when account is taken of the novelty of the powers and of their purpose. But the Minister hopes from now on it will be possible to make faster progress, especially in removing the smoke pall from the " Black areas " where air pollution is worst. The task of bringing under smoke control the large number of premises is a considerable one, and in the Minister's view it needs to be systematically planned and executed by local authorities.
>
> The Minister therefore asks that councils in black areas should now consider their domestic smoke problem as a whole (if they have not already done so) and decide on the smoke control orders that are needed, in what order of priority they should be made, and how many years it is likely to take to finish the job; and that they should then prepare a phased programme for establishing smoke control areas over the next five years. Informal consultation between neighbouring authorities on programming may be desirable.

Councils in black areas are invited to inform the Minister, by June 30th, 1959, of their conclusions, and an Appendix to the circular shows the form in which this information should be given. This provides for figures for the numbers of premises and dwellings, and acreages of smokeless zones and control areas covered by Orders up to the end of 1958, followed by estimated additions for the years 1960, 1961, 1962 and 1963. Further columns ask for figures for the final objective and the target year for the completion of the programme.

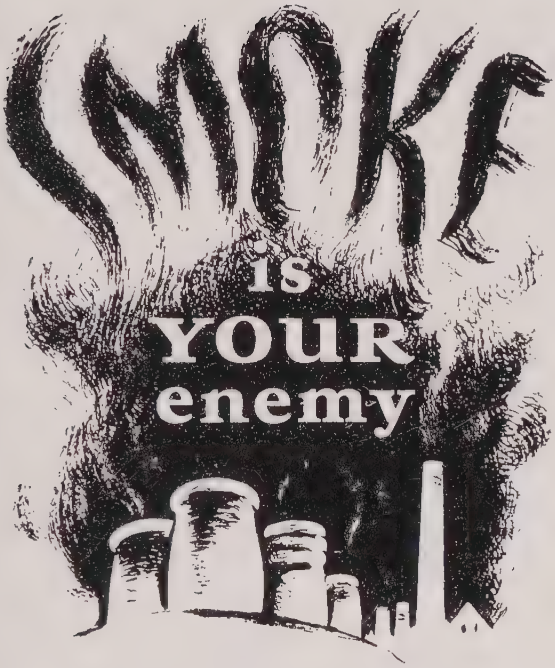
Other points made in the circular are:

1. New housing estates, whether built by the local authority or by private enterprise, should be smoke controlled from the outset.
2. Councils outside the black areas are not at present asked to provide such detailed information, but the Minister has no wish to suggest that outside the black areas a systematic approach to more localized domestic smoke problems is not needed.
3. The Minister hopes that the small number of urban authorities in black areas who have not yet made a building byelaw for smokeless heating and cooking appliances will now do so.

" SMOKE IS YOUR ENEMY "

New Government Leaflet

A leaflet, entitled *Smoke is Your Enemy*, the cover of which is illustrated above, has been prepared to answer the questions of householders in projected smoke control areas. It tells them about the menace of smoke and the part they can play in controlling it. Local authorities in England and Wales who are proposing to make



The cover of the new pamphlet

smoke control areas will distribute the leaflet, which has been prepared by the Ministry of Housing and Local Government and the Central Office of Information.

Smoke is Your Enemy describes very simply the harm caused by smoke in creating ill-health, dirt and waste, and explains how domestic smoke, which causes half the trouble, can be brought under control in densely populated areas.

The leaflet also explains the procedure for creating a smoke control area, and gives information about the type of fuel which may be used and the grants which are paid towards the cost of adapting fireplaces to burn smokelessly. It will be available, free of charge, to local authorities who propose to make smoke control orders, and is intended to supplement material giving local information.

A Ministry circular accompanying the leaflet also notes that the British Transport Commission have now appointed liaison officers who can give local authorities information about the progress of plans to replace steam locomotives by diesel or electric traction under the modernization scheme.

The Princess Royal Opens Clean Air Exhibition

H.R.H. the Princess Royal opened the Clean Air and Home Safety Exhibition held at York in December last. This was part of the West Riding Clean Air Campaign in which among other bodies the N.S.C.A. is co-operating. In the course of a speech Her Royal Highness said:

" Everyone desires clean air and recognizes its importance just as everyone recognizes the importance of clean food and clean water. We are all aware of the evils of pollution; the danger to health, the damage to fabrics and materials, the obstruction to sunlight, the increased costs of washing and cleaning, the damage to plant-life and the damage to buildings. In York, the last aspect of atmospheric pollution is one in which you have a special concern because of the insidious decay which is brought about by smoke-laden air to your ancient and beautiful buildings. Polluted air is an expensive luxury and it has been estimated that the annual cost in Great Britain of allowing a polluted atmosphere is £5 per head. It should not be forgotten that nearly half of all the smoke in the air comes from domestic chimneys and so the ordinary householder has as big a part to play in attaining a cleaner and smokeless air as has the industrialist.

" This exhibition shows some of the evils of air pollution and the measures which can be taken to prevent it. It is to be hoped that all those who see it will be stimulated to play a part in attaining clean air."

Sir Hugh Beaver

Sir Hugh Beaver, the Society's President, has been appointed a governor of Ashridge, the Bonar Law College in Hertfordshire.

SMOKE CONTROL AREAS

Progress Report

POSITION TO 31st JANUARY, 1959—TOTALS

	England and Wales	Scotland
Smokeless Zones (Local Acts) in Operation	44	1
Acres, 3,400		
Premises, 41,060		
Smoke Control Areas in Operation	31	1
Acres 3,634		
Premises 23,367		
Smoke Control Area Orders—		
Confirmed	48	1
Submitted	43	1
Proposals Notified	125	4
Grand Totals	291	8

The lists given below are supplementary to the information in the last issue of *Smokeless Air* (Winter, 1958), which gave the position up to October 31st, 1958. They now show the changes and additions to January 31st, 1959.

Some of the areas listed are new housing estates, or areas to be developed for housing. The total number of premises involved will therefore increase. An asterisk denotes that there have been objections and that a formal inquiry has been or will be held.

ENGLAND AND WALES

New Smoke Control Areas in Operation

Birmingham Nos. 1 and 2, Bolton No. 2, Dudley No. 1, Hayes and Harlington Nos. 2, 4 and 5, High Wycombe No. 5, Manchester No. 1, Oxford No. 1, Stoke Newington No. 1, West Bromwich No. 1, Woolwich No. 4.

New Orders Confirmed but not yet in Operation

Bedford No. 1, Dagenham No. 1, Dewsbury No. 2, Ellesmere Port No. 1, Fulham No. 2, Hackney No. 1, Halifax No. 1, Hayes and Harlington No. 6, Huddersfield Nos. 1 and 2, Lambeth No. 1, Leamington Spa No. 2, Leicester No. 2, Lewisham No. 1*, Liverpool No. 5, Oxford No. 2, Reading No. 1, Rotherham Nos. 1 and 3, Smethwick No. 1, Stoke Newington No. 2, Wood Green No. 1, Woolwich No. 2, Wortley No. 1.

New Orders Submitted for Confirmation but not yet Confirmed

Basildon No. 1, Battersea No. 1, Birmingham No. 3, Bristol No. 1, Crawley No. 1, Croydon No. 1, Dudley No. 2, Enfield No. 1, Heston and Isleworth No. 1, Hornchurch No. 1, Hornsey No. 1*, Kensington No. 1, Lewisham No. 2, Liverpool Nos. 4, 6 and 7, Paddington No. 1, Preston No. 1, Rochdale No. 1, Shipley No. 1, Wallesey No. 1, Wellington (Salop) No. 1, West Bromwich Nos. 2, 3 and 4, Westminster No. 2.

Proposals Notified to the Minister

Acton Nos. 1, 2 and 3, Altrincham No. 1, Barnet No. 1, Bermondsey No. 2, Bootle Nos. 1 and 2, Brighouse No. 1, Chelsea No. 1, Doncaster Nos. 2, 3, 4 and 5, Dudley No. 3, Edmonton No. 2, Felling No. 1, Finsbury No. 1, Friern Barnet No. 1, Hayes and Harlington Nos. 10 and 11, Irlam No. 1, Kensington Nos. 2 and 3, Leamington Spa No. 3, Leek No. 1, Leicester No. 3, Little Lever No. 1, Liverpool No. 8, Long Eaton No. 1, Mansfield No. 1, Poplar No. 1, Salford Nos. 1, 2, 3 and 4, Southall No. 1, Southgate No. 1, Stepney No. 1, Stoke Newington No. 3, Wakefield No. 1, Wandsworth No. 2, Wembley No. 1, West Bromwich Nos. 5 and 6, Westminster No. 3, Whitefield No. 1, Wigan No. 1, Woolwich Nos. 5 and 6, Wortley No. 2.

SCOTLAND

Smoke Control Areas in Operation

Edinburgh No. 1.

Orders Confirmed but not yet in Operation

Dundee No. 1.

GAS WARM-AIR HEATING IN AYLESBURY'S £1300 HOUSES

Two three-bedroom houses, complete with a gas warm-air heating system, have been built at Aylesbury at a price approximately £200 below the figure usual for a conventional three-bedroom house. The houses containing the warm-air heating system were erected experimentally by Aylesbury Council. Tenders are now out for the construction of an estate containing 200 similar homes.

The cost of the houses is approximately £1,350. This does not include land and road charges, but it does include the gas-burning F.45 Halcyon warm-air heating unit and an Ascot multi-point gas water heater.

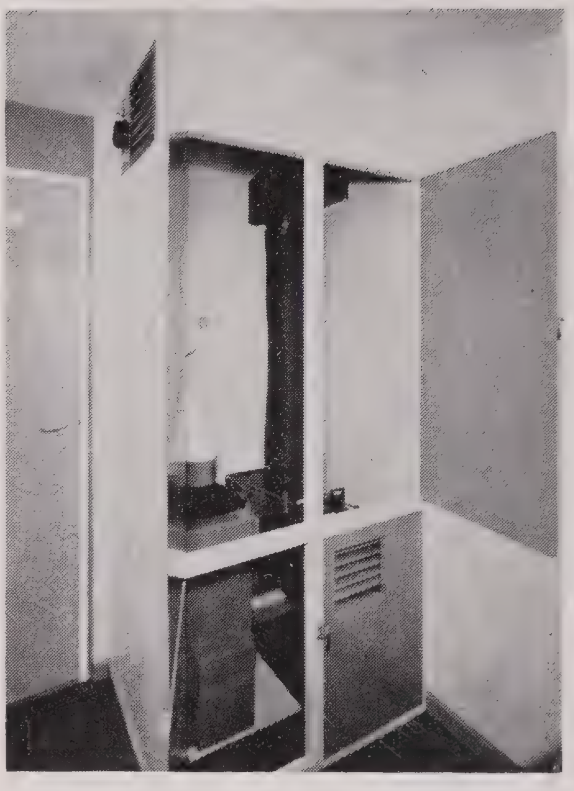
Both units are placed in the kitchen—the water heater in a cupboard under the draining board beside the sink, supplying hot water in the kitchen and in the bathroom, and the warm-air

Two of the gas heated houses at Aylesbury unit in a cupboard against the dividing wall between the kitchen and living room. A fan drives warmed air through ducts to outlets in the kitchen and living room. A third outlet, placed in the wall half-way up the staircase, emits warmed air which rises to provide effective heating for the upstairs rooms. The supply of warm air to each outlet can be controlled separately by the operation of levers attached to the Halcyon unit. The temperature can be controlled by the householder by means of a room thermostat. The return air inlet is arranged below the outlet in the living room.

The total cost of the warm-air heating unit, including thermostat and automatic controls, is about £90 per house. Because ordinary fireplaces are omitted, there is a saving of about £40 per house due to the fact that conventional brick-built flues are not necessary. The heating unit does not supply hot water, and the gas water heater is installed to provide this service.

No additional heating is necessary in the Halcyon-equipped houses—and the operating costs of the unit are surprisingly low. Aylesbury Council believes that its tenants will find the gas costs for the heater unit are not likely to exceed 12s. 6d. a week for a 32-week heating season, or an average of 8s. a week for the whole year.

So far, the Council has not fixed the rents for the luxury-heated houses, but it is estimated that a private economic rent would be £2 7s. 6d. a week, excluding rates. Rates, at 12s. 8d. a week including water rate, would bring this figure to £3 0s. 2d.



The Halcyon Warm-Air Heating Unit

Large Smoke Control Area for Leeds

Leeds Corporation Health Committee is expected to instruct the making of a very large Smoke Control Area. It will take in 10,700 buildings, about 5,000 of which are houses, many of them requiring new appliances for burning smokeless fuels.

The D.S.I.R. fuel research station at Thornton Hall, East Kilbride, Scotland, is now devoted exclusively to the problems of air pollution. The name of the station has been changed to Warren Spring Laboratory, Scottish Branch.

Proposed Amendment to Clean Air Act

The Minister of Housing and Local Government is being asked by Basildon Council to amend the Clean Air Act to make it an offence for merchants to sell non-smokeless fuel in smoke control areas.

American Exhaust Fumes Bill

A Bill to make it illegal to sell new cars without a device to reduce exhaust fumes, after July 1961, has been submitted to the California Assembly at Sacramento.

The Winter's Fogs

Some Interim Reports

WE are indebted to the Medical Officers of Health of the cities most severely affected by fog during the past winter for the following notes. They were of course written before any detailed statistical information on the January and February fog periods could be collated and analysed.

Liverpool

The readings taken from volumetric instruments situated in the central area of the city indicate that the density of suspended matter was at least ten times heavier than the normal average, the highest recording during the peak period being 5·45 lbs. to 6·48 lbs. per million cubic yards, while the normal reading for this time of the year varies between ·54 lbs. to 1·5 lbs. per million cubic yards.

A special scientific investigation into the degree of impurities in the atmosphere was in progress during this period, and a member of the team remarked that Liverpool's fog mixture appeared to be wetter than smog in other areas.

There was a marked effect on the wild bird life in the city and a number of starlings were found dead as a result of the smog, having suffered extensive pulmonary damage and died from asphyxia.

For the first time in Liverpool for many years there was a complete standstill of traffic, and clerical workers numbering thousands were compelled to walk distances averaging from five to ten miles before they reached their homes. Motorists in the area complained bitterly of the excessive sticky coating that had to be removed from their vehicles after the fog.

The river traffic was at a standstill, apart from ferry boats using radar which enabled them to maintain a 30-minute service instead of the usual 20 minutes. At least a dozen ships were kept waiting for docking orders at the bar, some for as long as three days. Other vessels waiting to sail were trapped in the channel and docks, and planes using Liverpool Airport were grounded on three successive days.

Some of the adjoining areas reported an increase in the number of persons admitted to hospital as a result of the fog. There has been, as yet, no undue anxiety within the city as the increase did not reach any alarming proportions.—*Professor Andrew Semple.*

Manchester

Unfortunately I am not yet in possession of official mortality or morbidity statistics to enable a completely reliable appraisal of the possible relationship between the smoke and sulphur dioxide concentrations. However, having due regard to the smallness of the figures for statistical purposes it does seem that there was an increase in mortality due to bronchitis approximating to the peaks of concentration of smoke and sulphur dioxide.

Concerning those concentrations during the period Sunday, January 26th, to Friday, January 30th, 1959, with a virtual absence of wind and with low air temperature, fog was intermittently experienced with maxima of smoke and sulphur dioxide for the 24 hours ending at 11 a.m. on Monday, January 26th, and Friday, January 30th. The smoke measurement on Monday morning, January 26th, was 334 mg./100 m.^{3}, and on Friday morning, January 30th, was 358 mg./100 m.^{3} The figure for the previous 24 hours was 219 mg./100 m.^{3} The sulphur dioxide concentrations were 74·9 p.p. 100 m., and 86 p.p. 100 m., preceded by 35·7 p.p. 100 m. on

January 29th.

The conditions during the morning of Friday, January 30th, were further aggravated by a bank of cloud which I understand was at about 4,000 feet, completely cutting off daylight until after midday, when there was a fairly rapid change with a slight easterly wind producing clear conditions.—*Dr. C. Metcalfe Brown.*

Salford

Competent observers stated, according to several press reports, that the smog in parts of the North-West last week (Thursday and Friday, January 29th and 30th) was the worst in living memory. In addition to the usual consequences and social costs such as dislocation of transport, much deposition of dirt on streets, buildings, and furnishings, the demand for hospital beds increased sharply.

In one industrial area (Salford) the foggy period was characterized by a widespread smoky haze with a visibility of no more than 200 yards and laboratory measurements showed the smoke and sulphur dioxide to be on the average 120 milligrammes per 100 cubic metres and 35 parts per million respectively; i.e., approximately twice the normal amount of each impurity for an average January day.

At certain times, however, as instanced by Sunday evening of January 25th, the fog became dense and on inspection of the stains produced on the filter papers of the measuring apparatus the following Monday morning were too dense to permit of measurement, although by then the fog had completely cleared.

On Thursday afternoon, January 29th, the fog again became dense so the smoke paper was changed at 4.30 p.m. the average smoke concentration for the day being 415 milligrammes per 100 cubic metres, approximately seven times the normal January average. After being left overnight the smoke stains were again too dense to permit of measurement, but the sulphur dioxide amount was found to be 109 parts per 100 million, i.e. approximately six times normal.

During the morning of the following day it became very dark, the actual fog, however, not thickening at ground level but remaining suspended higher up almost completely excluding daylight. The smoke and sulphur dioxide concentrations were measured during this period and found to be 478 milligrammes per 100 cubic metres and 164 parts per 100 million respectively, i.e. approximately eight times the normal January average.

It will be seen that the concentration of smoke and sulphur dioxide were both higher than in the peak period of the London smog from the 5th to the 9th; but fortunately the duration of the fog was much shorter.

The demand for hospital beds necessitated putting into operation the so-called " emergency plans " whereby hospitals refused certain non-urgent cases. The waiting lists were particularly long in respect of elderly female patients. Another noticeable feature was that acute respiratory disorder occurred more frequently in patients already in beds in acute hospitals having as a result an increase in the number of " blocked beds " of patients who could not be transferred to home or to a hospital admitting the aged chronic sick.

It is as yet too early to assess the mortality and morbidity statistics though there is preliminary evidence to suggest that both show a definite increase in certain urban and industrial areas.

There is no doubt that the public are increasingly conscious of the nuisance of loss occasioned by smog, and if newspaper columns are an indication, public opinion is now decisively in favour of a speed up in the implementation of the Clean Air Act, 1956.—*Dr. J. L. Burn.*

Glasgow

Glasgow and the Forth and Clyde Valley have had more than their fair share of fog this year. On November 30th and December 1st there was dense and persistent fog covering a distance of 25 miles around Glasgow.

It was the worst fog for at least 25 years. Visibility was reduced to 0 to 25 yards, there was serious disruption of traffic and transport services, the shipping on the river was halted, and road accidents increased. Air pollution rose rapidly until by 6 o'clock on Monday, December 1st, its density was ten times the usual winter level. Within 36 hours the smog had disappeared completely and the air was clean and fresh again.

During the next eight weeks fog was present in the city from time to time, but with recessions and periods of complete remission.

The next worst period was from Saturday, January 31st, to Tuesday, February 3rd. The fog in Glasgow was dense in places and visibility again down to 0 to 25 yards, with resultant disorganisation of traffic, particularly in the evening. During this period the fog was widespread and dense over the Forth and Clyde Valley, and Glasgow had its worst fog in living memory. The temperature did not rise above freezing point, and at times was as low as 16°F., and hoar frost fell like snow.

There was pressure on hospital accommodation and numerous demands for oxygen supplies. As usual during the winter months, notifications of primary pneumonia increased rapidly. The Western Regional Hospital Board's Admission Bureau found it necessary to have a waiting list for admission to hospital, although all cases were admitted within 12-18 hours of intimation.

While the incidence of pneumonia was high, deaths from this disease during the worst periods of fog corresponded fairly closely to the figures for the comparable weeks in 1957 and 1958. Deaths from bronchitis, however, trebled in the weeks ending December 6th and 13th and doubled in the week ending December 20th as compared with the corresponding weeks in the previous year. Then, again, after the incident of January 31st to February 3rd, deaths from bronchitis increased, and in the week ending February 7th they were four times the comparable figure for 1958.

With the disappearance of the fog by the evening of Tuesday, February 3rd, the number of deaths from bronchitis decreased. The winter, however, is not ended, and fog is again present in the city.—*Dr. W. A. Horne.*

Edinburgh and London

From Edinburgh, Dr. J. L. Gilloran, Deputy Medical Officer of Health, informs us that contrary to reports prevalent in the South, Edinburgh very largely escaped the recent fogs in the Forth-Clyde valley. On Sunday evening, February 1st, conditions justified a smog warning to elderly people and sufferers from chest complaints to remain indoors, but there does not seem to have been any increase in mortality or morbidity attributable to the fogs. During the past winter London has had its foggy days, but as far as is known without any build-up towards conditions of real smog. Dr. Scott, Medical Officer of Health for the London County Council, speaking from the Chair at a recent meeting of the Royal Society of Health, stated that average pollution conditions in London showed a material improvement over the previous two winters. In November, 1958, smoke in the air was in fact only 46 per cent. of that for the same period in 1956, and sulphur dioxide was 68 per cent. of that in 1956.

A.P. on TV

The B.B.C. featured an excellent television programme on February 13th, compered by Robert Reid, on a report on smog. It mainly featured the progress being made in Manchester. On February 9th the ATV feature " Right to Reply," with William Clark as Chairman, took the form of a discussion on clean air and smog with the Medical Officer of Health of a London borough and the Director of the N.S.C.A.

THE COST OF A FOG

The following informative survey, compiled by its own Reporters, was published in " The Manchester Guardian " on 31st January, 1959. It is reproduced by kind permission and with our appreciation.

THE fog which blacked out Manchester yesterday morning and that which paralysed London on Thursday probably cost the country about £50 millions. A spokesman for the National Society for Clean Air said yesterday that he thought that figure " would not be an over-estimate " for the two days. The Society had calculated previously, he said, that a bad fog cost the country some £30 millions a day, about a third of which was accounted for by the London area.

A large part of this cost is loss of revenue and increased cost on the nation's transport systems. The cost to airline operators is particularly high. B.E.A., for instance, has lost £200,000 during the past three months because of bad weather. An official estimated that Thursday cost the company £20,000. On that day ten B.O.A.C. aircraft coming into Britain were diverted to Prestwick. The cost of each diversion was between £500 and £750. Air France was another sufferer. Thursday's fog cost them about £4,500, and a week-end fog is even more expensive, usually costing £6,500.

Other airlines reported similar, though smaller, losses. As the figures depend on many factors it is often hard to arrive at an exact determination, and in most cases fog is not considered separately in the costing of airline operation. Much of the money is recoverable. People rebook with the same company, and the cancellation of an uneconomic flight might be a blessing in disguise. This is not a time of year when aircraft traffic is heavy, and repairs or maintenance can still be carried on in the thickest fog.

Airports' losses

The airports, however, do lose money if flights are cancelled or planes diverted. A 24-hour closure of Manchester Airport costs the corporation £1,000. The figure for London Airport is nearer £8,000. This is merely a loss of revenue, and does not take into account the losses suffered by shops, dining-rooms, hire-car services, and others who gain their living from the airport.

During November fog was largely responsible for the drop in activity at London Airport (and the corresponding increased activity at Blackbushe, Hurn and Newcastle). Air transport movements at London were 3·5 per cent less than the corresponding figure for last year, but those at Blackbushe were 110 per cent higher, Hurn 100 per cent higher and Newcastle 143 per cent higher.

Sea traffic is also held up. In the Port of London on Thursday there were between fifty and sixty ships unable to move. These included 38 overseas liners which could not dock and thirteen overseas freighters whose loading was delayed. The cost to the shipping companies varies enormously. It depends on the size of the ship, whether it is a freighter or passenger vessel and what type of cargo it has on board. A rough estimate puts the figure of £500 a day on an average, but some ships cost considerably more and others considerably less.

At Liverpool on Thursday six ships were unable to leave the harbour and three were forced to wait outside the bar. A shipowner estimated the cost of this one day as " in the neighbourhood of £5,000," and other ports had the same sort of story to tell. The Manchester Ship Canal was closed yesterday morning, but the other small canals were all open, and barges did not seem affected by the weather.

The railways, the Post Office, and London Transport all stated that they had never attempted to make any estimate of what a fog usually cost them. Manchester Corporation Transport Department, however, estimated that a day of bad fog cost about £3,500—£3,000 loss of revenue and £500 in increased costs, mainly in overtime to delayed bus crews.

Lift for Laundries

Probably more than £1 million of the general cost of fogs will come out of families' weekly housekeeping money. A large proportion of the country's 14,500,000 households must have been affected by the fog, and according to one local government official " a bad fog generally puts half-a-crown on the housewife's budget."

Laundries and dry cleaners agreed that a fog brought them increased business. A spokesman for the Institute of British Launderers said that laundry managers liked a heavy fog at the beginning of the autumn. It puts people into the habit of using laundries right through the winter. One large London laundry thought the fog this week would swell its business by about 10 per cent.—in a month's time, when people thought the worst of the fogs were over for the winter.

Air pollution in general cost the country about £250 millions a year, according to the Beaver Report in 1954. The report also estimated that between £25 millions and £50 millions was lost every year through the incomplete combustion of fuel, which is one of the main causes of smoke. The cost of making the Clean Air Act effective has been estimated at between £500 millions and £600 millions.

Travel agents seem to be among the few people profiting from the fog. One Birmingham travel agent said that summer holiday bookings were already 10 per cent. up on last year, and that the number of inquiries had increased markedly in the last ten foggy days. " Subconsciously people seem to have been thinking about sunshine, and the fog has made up their minds. On some of the worst days we had most people in. In fact some people came to inquire about summer holidays on days when I wouldn't have gone out for anything."

There has also been brisk trade for chemists who stock smog masks. One chemist in the centre of Manchester sold 2½ gross of smog masks before ten o'clock in the morning, when stock ran out. From then on, this shop reported, every second customer wanted to buy a smog mask.

From the Divisions

Yorkshire

The annual general meeting of the Yorkshire Division was held in Leeds on November 14th, 1958, with Mr. A. C. Saword in the chair. Mr. E. J. Winfield, Deputy Chairman, spoke on the problem of miners' concessionary coal, which he considered to be the biggest obstruction to clean air in the Yorkshire Division. While appreciating the tremendous obstruction that this made to progress, he suggested that those people who were not of the industry were not really fitted to judge the position accurately. He urged the need for securing a proper settlement of the problem on a national basis, to bring together the viewpoints of the N.C.B. and the N.U.M.

Mr. Saword thought more should be done to dispel the idea that coke fires were injurious to health. He was quite satisfied that this was not so. Several speakers referred to the question of igniting coke fires if no gas was available. Possible alternatives suggested were the use of electric, oil or Calor gas lighters, or some type of chemical fire lighter.

North-West

A meeting of the North-West Divisional Council was held in Manchester on February 26th, at which a discussion on the establishment of smoke control areas was opened by Mr. A. Wilson, Regional Director of the Ministry of Power.

West Midlands

The annual general meeting of the West Midlands Division will be held in Birmingham on March 25th.

CANCER AND BRONCHITIS MORTALITY AND AIR POLLUTION

A New Investigation

The *British Medical Journal* of 10th January, 1959, published an important communication from Dr. Percy Stocks, C.M.G., M.D., F.R.C.P., on an investigation into cancer and bronchitis mortality in relation to atmospheric deposit and smoke.

Dr. Stocks says: " Two diseases for which the urban excess is very pronounced are bronchitis and lung cancer, and this is so in some regions for gastric cancer, whereas cancers of the intestine and breast show little relation to urbanization in Britain. The death rates from bronchitis and lung cancer are higher than in any other country, as is also the amount of air pollution from domestic chimneys; and in countries where coal is little used for domestic heating the urban excess is much smaller. In view of these facts atmospheric pollution of the kind found in British towns has been under suspicion as a causative agent both for bronchitis and for lung cancer, and I have suggested that pollution of food by exposure to dirty air might be a cause of the higher incidence of gastric cancer in towns. This paper records an attempt to obtain more conclusive evidence on these points by relating standardised mortality from bronchitis and cancers of four sites, with measurements of atmospheric deposit and suspended matter (smoke) in the county boroughs of England and Wales and in the administrative areas of Lancashire and the West Riding of Yorkshire, where such measurements have been made."

After discussing previous work the paper describes the method of study—the areas investigated, and the pollution figures as recorded in the report on the Investigation of Atmospheric Pollution (D.S.I.R.) for 1954. Despite certain weaknesses in the method " it was thought worth while to find whether or not correlations do exist between deposited matter and/or smoke and mortality from cancer and bronchitis in large towns and smaller areas, taking account of the population densities which could produce such correlations indirectly."

The paper then discusses the results, which involves tables and statistical analyses too long to be reproduced here, and therefore we give only Dr. Stocks's conclusions and summary:

" When standardised mortality ratios for bronchitis and cancers in the county boroughs of England and Wales are related to the average amounts of undissolved deposit and smoke from the air in those towns, highly significant statistical correlations are found for bronchitis and lung cancer with both types of pollution after eliminating the effects of population density on the correlations. In all administrative areas in Lancashire and the West Riding of Yorkshire having the necessary pollution data bronchitis is significantly correlated with deposit but not with smoke, whilst for lung cancer the reverse is the case. In Lancashire areas lung cancer is strongly correlated with population density in adjacent districts even when that of the area itself is held constant, and this appears to confirm the effect of wind-borne smoke on the incidence of the disease.

" Stomach-cancer mortality is related significantly with both deposit and smoke in the country boroughs, and among females in the Lancashire and Yorkshire districts also, whereas breast cancer shows negative correlations in the county boroughs and no relations with air pollution in the counties. The most likely explanation of this is the exposure of food to dirty air, and this hypothesis is fully supported by the fact that in the U.S.A., where wrapping of food was the rule

(*concluded, page 199*)

New Publications

International Journal of Air Pollution, Vol. I, Nos. 1 and 2, October, 1958. Pergamon Press, London and New York.

A foreword to the first number of this journal refers to it as a journal of research and explains its scope and purpose. " In recent years," says the foreword, " the problems posed by air pollution have been tackled by people who previously had little in common: among them are meteorologists, fuel engineers, physical chemists, public health inspectors and doctors. They have tended to publish their findings in journals devoted to their own specialities and their progress has not easily become known to others."

" As research in air pollution proceeds," continues the foreword, " scientists become educated in related disciplines: the engineer and chemist learn some meteorology, the fluid dynamicist some medicine; all become aware of the associated economic and legislative problems. For this reason, we shall publish review articles which will describe progress in the study of air pollution from many different standpoints."

The journal is purchased by annual subscription, the rate being £6 per volume (presumably four numbers), or £3 10s. for private individuals certifying that it is for private use only. The first issue of 154 well-printed pages in large octavo consists of Numbers 1 and 2. It includes eleven research papers, two review articles, reports of meeintgs and reviews of publications.

The papers cover a wide field and range from some of general interest and importance, such as Dr. Percy Stocks on the air pollution and cancer mortality survey in the Liverpool region and North Wales, to others of a more esoteric importance, such as that on the coalescence of droplets in aqueous-disperse aerosols. To use the word esoteric is not to criticize the value of such papers but simply to indicate that they are likely to be studied only by a small number of specialists. Abstracts of some of the papers are included in our Air Pollution Abstracts on another page.

Among the papers mention may be made of one from Cincinnati on " Some Factors in the Design, Organization and Implementation of an Air Hygiene Survey," which is of interest in showing how thoroughly the Americans organize such a project. Another, of considerable importance, is by D. H. Lucas of the Central Electricity Authority's Research Laboratories, on " The Atmospheric Pollution of Cities." This assesses the pollution levels for sulphur dioxide and smoke likely to be produced by the thousands of domestic fires in large cities. It shows that the major part of the pollution of large cities can be attributed to domestic fires, even though the concentration due to a single fire is negligible.

The journal has four editors, of whom three are British (G. Nonhebel, Dr. R. S. Scorer and Dr. John Pemberton), and one American (Prof. A. J. Haagen-Smit). There is also an Advisory Board of 45 members, representing twelve countries.

We wish the new publication every success. It should meet a need that *Smokeless Air*, for example, cannot and does not seek to satisfy. Its main problem would seem to be to achieve a reasonably wide readership by devoting itself to what must perforce be highly specialized contributions. It is an admirable purpose, to bring together, as the foreword says, the various disciplines that enter into the study of air pollution. It is hoped, however, that the temptation will be resisted of tending to look upon air pollution as a discipline or branch of science in its own right. Unlike a science, the purpose of studying air pollution is to render further study unnecessary.

Sanitary Officers Practice: Environmental Hygiene. Edited by Stewart Swift. pp. 781, plus index. Butterworth, London. 85s. net. (87s. by post).

This comprehensive textbook on environmental hygiene is the fifth and final volume of the series edited by Mr. Swift. The other responsibilities of the Public Health Inspector are covered by the earlier volumes, on administration, food and drugs administration, food inspection, and housing administration. Even taken by itself, however, the new volume is an impressive indication of the variety and breadth of knowledge the P.H. officer must possess.

It is outside our province to seek to review the whole of "Environmental Hygiene," which contains ten separate parts, by different authors. Part V, on atmospheric pollution, is our particular interest. The author is G. A. Hiller, C.P.H.I., of Leicester, and previously of Bolton. Mr. Hiller deals with his subject in an informative and succinct way that will be valued by those dealing with air pollution in practice, and he puts a good deal into the 75 pages allotted to him. He reviews the causes and effects of pollution, its investigation and measurement, and then goes on to explain the physics and chemistry of combustion, following with a chapter on boilers and furnaces. The new conditions of control arising from the Clean Air Act and the many questions arising from the establishment of smoke control areas are touched upon, though not at length.

The first section of the book, on air, ventilation, heating and lighting, is also of importance from the clean air viewpoint, and is excellently done by James Goodfellow, C.P.H.I., of Leeds, and a member of the N.S.C.A. Council. He is also responsible for the last part of the volume, dealing with special premises. Other sections are also written by present (Dr. W. C. Turner, on Environmental Diseases) or past (F. R. Jefford on Rodent and Insect Pests) members of the N.S.C.A. The Editor, Stewart Swift, was also a member of the Council for some years, and we congratulate both him and his team of collaborators on the production of a most important work.

Supplement to Coke-Burning Appliances Handbook. Gas Council.

This supplement lists appliances to those listed in the 5th edition of the Handbook, published in September, 1957. It contains the essential information of a further 25 open fires, stoves, boilers, etc.

Nuclear Power to Clear the Air. Electrical Development Association.

This is an illustrated brochure of 12 pages, with illustrations, for the information of officers and members of local authorities. The references to the production of electricity in the future from nuclear generation are brief, but the booklet gives useful information about the uses of electricity here and now in housing, and especially in relation to smoke control areas.

The Use of Small Coal—Today and Tomorrow. Institute of Fuel.

This volume is the Proceedings of the Conference on small coal organized by the Institute in May, 1958. Containing all the papers and discussions, it is a very useful contribution to the important problem of how to dispose of the growing stocks of small coal—with references to how to use them smokelessly. The conference was reported in *Smokeless Air*, No. 106, Summer, 1958.

Road Diesel Smoke Considerations. Mobil Oil Company Ltd.

The Mobil Oil Company Ltd., Caxton House, Westminster, S.W.1, have published as an Automotive Engineering Memorandum, a concise and factual pamphlet on this problem. It discusses the two types of diesel smoke, the carbon monoxide content of diesel exhaust, fuel characteristics, mechanical conditions, and the influence of cooling water temperature. The conclusions reached are as follows:

" On certain broad lines, all the available information seems to agree:

1. The mechanical condition of an engine and adjustment of its fuel injection equipment overshadows any other factor or combination of factors relating to exhaust smoke.

2. Engine cylinder jacket cooling water temperature probably comes next in influence.

3. Within the range of fuels normally used in high-speed automotive diesel engines, fuel characteristics can be significant but are often subordinate to the above-mentioned."

Three recommendations are made:

1. Consideration be given to altering injection pump settings to promote minimum smoke where this dominates maximum output.

2. Injection equipment maintenance periods and practices be reviewed for possible shortcomings.

3. Driver education, particularly where misuse of the excess fuel device is possible.

The memorandum can be recommended to all who are interested in this growing problem of diesel exhaust emissions.

Overseas Publications Received

As a result of making new contacts due to the sending out of invitations to the Diamond Jubilee Conference the Society has received a number of publications that it is very glad to have for the Library. Among these may be mentioned the following:

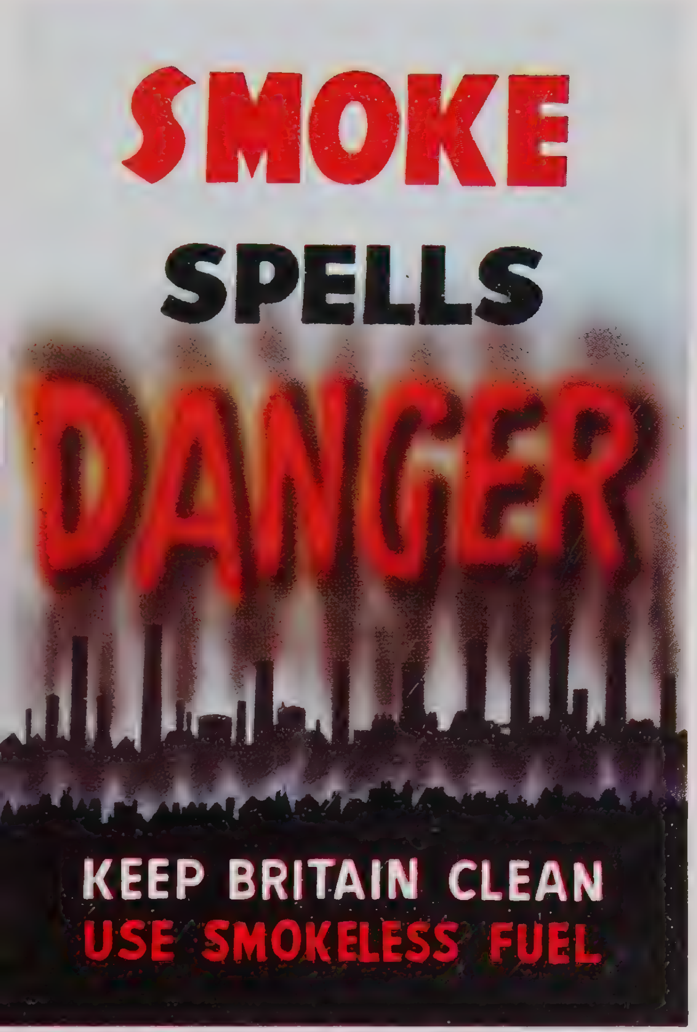
Selected Articles—Research Institute for Air Handling Equipment, Prague. This volume contains an article (in German) by Dr. Theodor Petrysin on " Air Pollution and its Measurement." The article treats the problem of determining the dust content in the neighbourhood of a large power station located in a broad valley. The author describes two simple methods of measuring the dustfall in a horizontal direction, including microscopic analysis of the dust particles. The method is based upon the sedimentation of particles on aluminium plates provided with thin films of vaseline. The results are introduced in figures and diagrams. Simultaneously the meteorological effects are evaluated for the region. Another article, by Ing. Dr. Jaroslav Böhm, is a " Contribution to the Calculation of Electro-Precipitators."

From France comes a volume on the *Quatrième Collogue sur les Poussières* (Paris, pp. 131). Published by the Institut National de Sécurité pour la Prévention des Accidents du Travail et les Maladies Professionelles. The volume is the Proceedings of a conference held in March, 1957, and includes a series of papers on progress in essential questions concerning the examination of industrial dusts; practical applications; and the problems of documentation and the results of investigations. A report on a *Journée de Dépoussiérage des Fumées et Gaz Industriels* (pp. 215) has been received from the Institut Francais des Combustibles et de L'Energie. This is the Proceedings of a conference on dust and grit removal held in Paris on June 18th, 1954. It contains twelve papers.

From Brussels comes a reprint of an article from *La Revue Generale Belge* by Jacques Delcroix, on "The Pollution of the Air that Kills." M. Delcroix is Administrator of the League for the Prevention of Cancer, but this paper covers the wider field of the consequences of air pollution.

Cancer and Bronchitis—*continued*

long before it began to be practised in Britain, death rates from stomach cancer have fallen steadily in contrast to their lack of improvement in this country. Intestinal cancer also shows small correlations, with deposit and smoke in the county boroughs, but they are below the conventional level of significance."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KEEP BRITAIN CLEAN
USE SMOKELESS FUEL

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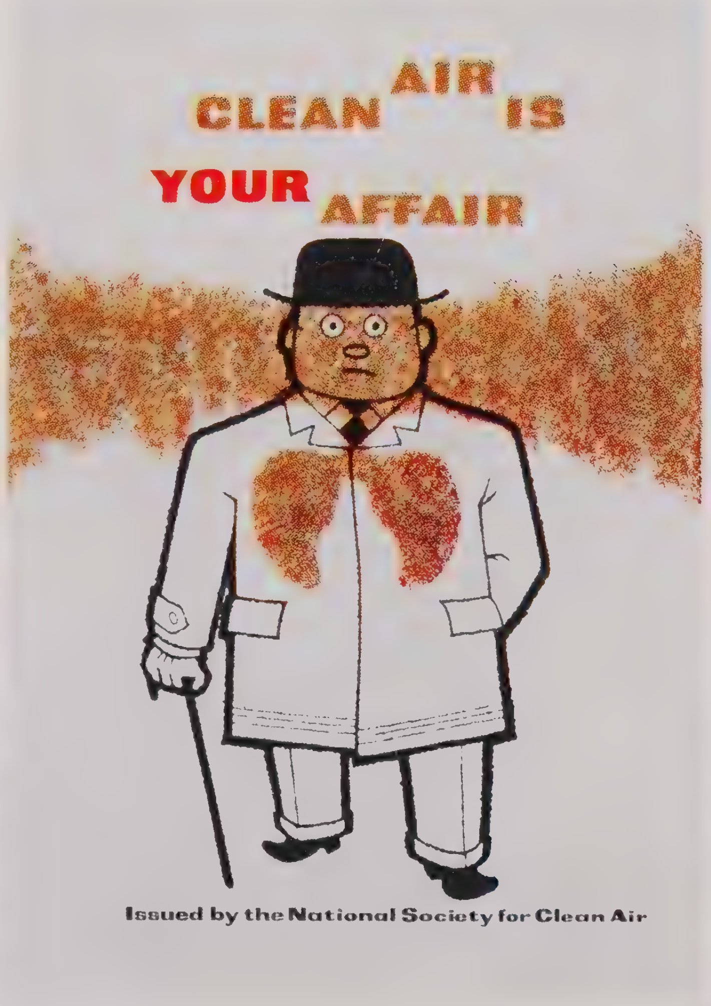
CLEAN AIR IS
YOUR AFFAIR
Issued by the National Society for Clean Air

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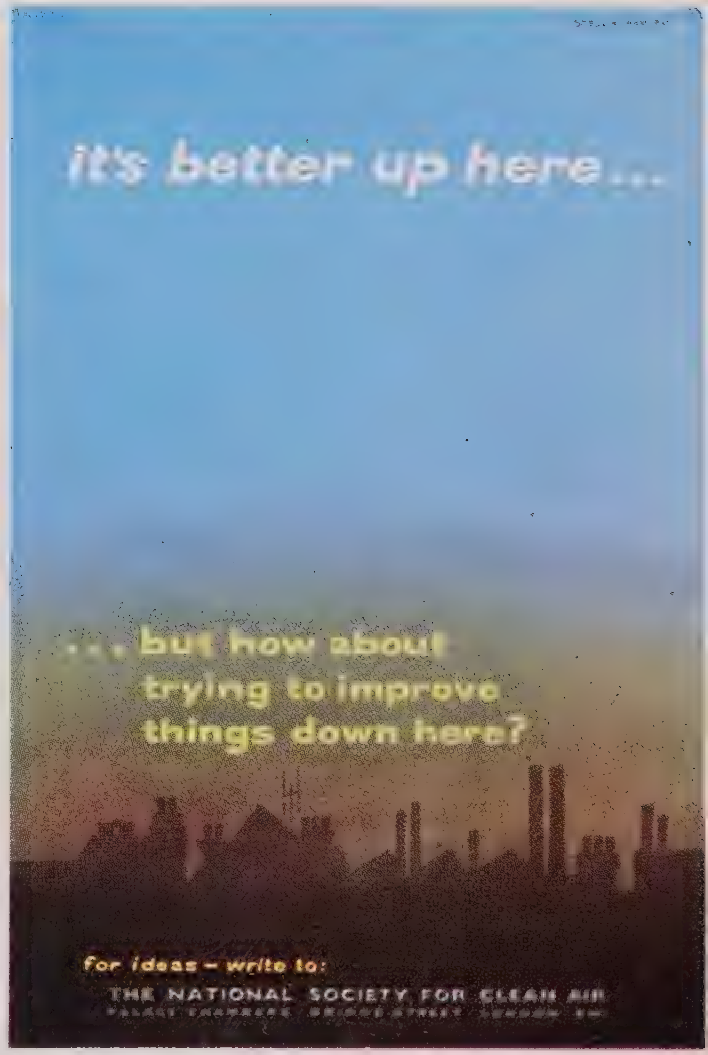
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THE NATIONAL SOCIETY FOR CLEAN AIR

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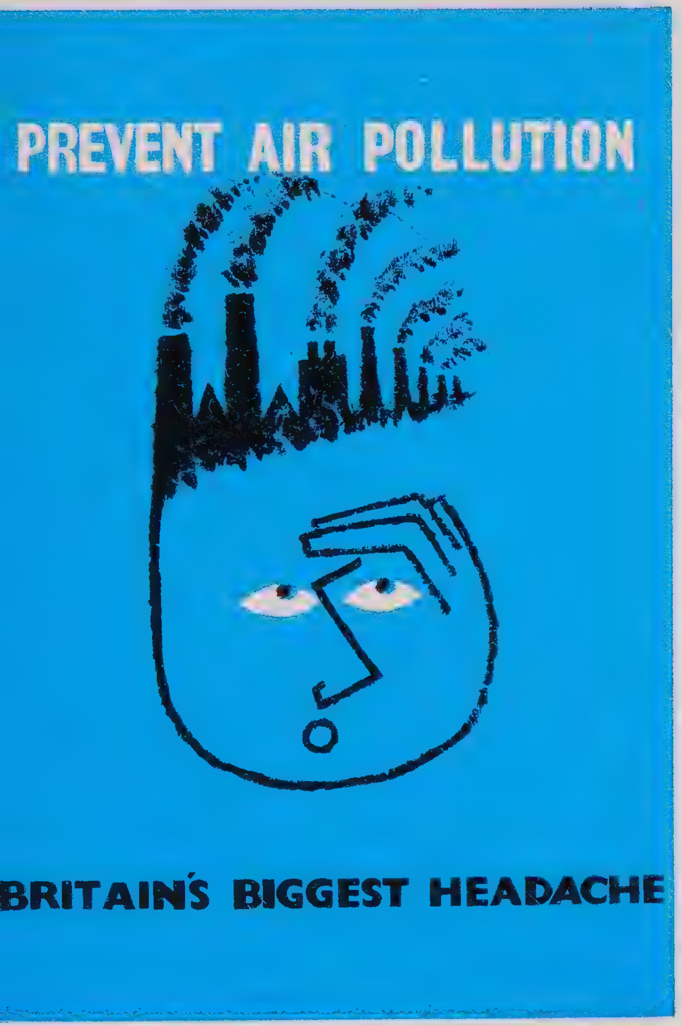

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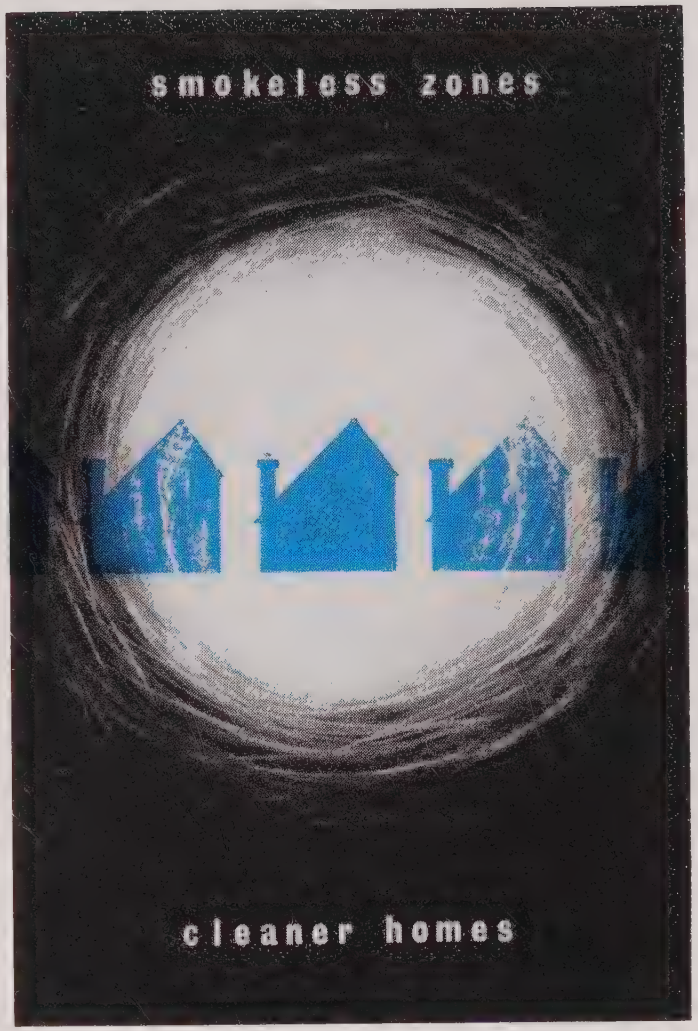

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The New Posters

Illustrated are the Society's new posters (also mentioned in an editorial note). Designed for use in clean air publicity campaigns and for display in schools, clinics, showrooms, etc., it is hoped that they will be widely displayed. The size is 30 by 20 inches. The posters shown are now being printed and orders can be taken. Prices, including post or carriage, are as follows:

One copy ..	1s. 9d.
Per dozen ..	£1 (NSCA Members, 18s.)
Per hundred	£7 10s. (Members, £6 15s.)

Special quotations for 500 or more. Orders for quantities may be mixed. Please order by the number under each poster.

SMOKELESS FUEL PRODUCTION

An Important Advance

A COMMUNICATION to *Nature* (No. 4653, 3rd January, 1959), signed by four members of the staff at the Coal Research Establishment of the National Coal Board, at Stoke Orchard, outlines investigations that promise important new techniques for the production of solid smokeless fuels.

Coal, when incompletely burned, creates smoke by the emission of volatile matter that has escaped combustion. This consists largely of small particles and droplets of tarry matter. " It has been accepted in the past," states the communication, " that coals are effectively smokeless when they contain less than 20 per cent. of volatile matter," and it points out that among the smokeless fuels approved for the purposes of the Clean Air Act are the low volatile steam coals ranging in volatile content from 9·1 to 19·5 per cent. The manufactured fuels have a content near to or less than the lower level of this range. Consequently, the assumption is sometimes made that, in order to be smokeless, coal products must have their volatile content reduced to less than 20 per cent.

It is shown that this assumption is unjustified. Earlier work in America and the investigations at Stoke Orchard have shown that it is possible to produce chars which are smokeless although their volatile content exceeds 20 per cent. At the Coal Research Establishment high volatile coals have been partly devolatilized by fluidized carbonization, and briquettes made from a char of 33 per cent. volatile content emitted less smoke than a steam coal of 18 per cent. volatile content. When made from a char of about 23 per cent. volatile content the briquettes were completely smokeless.

The reason for this, as a series of investigations has shown, is that the smoke emission of coals and chars is mainly determined by the yield of tar on carbonization. The char with a volatile content of about 23 per cent. is smokeless because its tar content is small. In other words, it is important to eliminate that part of the volatile content which produces tar; the rest does not matter.

A second factor also contributes to the low yield of tar from a smokeless char. Coal carbonized in two stages, first up to 425°C. to give a smokeless char, followed by carbonization of the char up to 550°C., gives a lower total yield of tar than if the coal is carbonized in a single stage to 550°C. This is because when carbonization is carried out to a fixed upper temperature in two stages, some of the intermediate products formed, which would be evolved as tar in a single stage carbonization, remain longer in contact with the heated coal and are themselves converted by further reactions to a solid char. The latter is smokeless on subsequent combustion.

A full account of this work is to be published, but from the outline of which the above is a summary it would appear that freely burning smokeless solid fuels for the open grate may in the future be produced from high-volatile small coal by a carbonization process which is more rapid than conventional methods and consequently can attain a much higher throughput per unit of plant. Moreover the method is particularly suited to those coals which have no caking power, and which would therefore be normally unsuitable for the production of coke. The present surplus is mainly of coal of this type.

It is further reported that designs are now being prepared under contract for a pilot plant capable of producing 120 tons a day. Subject to satisfaction about costs, the Board is thinking of an annual output of around 500,000 tons.

During the process the finely ground coal is fluidized, *i.e.* maintained in a state of continual agitation, by a stream of hot air passing through the coal bed. The product is a char which requires binding into briquettes, unlike the coke that is formed when a caking coal is heated out of contact with air. The char can be formed into briquettes by either of two processes. In one of them the hot char is bound together with a small amount of untreated coal and pitch; the other relies on straightforward compression. It has yet to be decided which method will be best.

The communication to *Nature* was signed by W. N. Adams, A. F. Gaines, D. H. Gregory and G. J. Pitt.

DOMESTIC HEATING OPINION

A C.O.I. Survey

A survey into domestic heating published recently by the Central Office of Information contains a number of facts and comments of interest to those especially concerned to promote the introduction of smoke control areas.

About half of the households with improved fires—the appliances likely to be provided in smoke control areas —were not burning coke at all, but coal. Within this group about half had never even tried coke. Among those who had used coke but were no longer doing so, 47 per cent gave as their reason " Coke won't burn," 28 per cent said it gave off fumes, and 10 per cent said its heat was insufficient. "Spitting," expense, and difficulty in obtaining the fuel were also fairly high on the list of complaints.

The answers suggested to Mr. P. G. Gray, who conducted the survey, that " many housewives may need instruction on how to burn coke successfully and that there is a great deal of prejudice to be overcome when smoke control areas are established."

The survey was conducted on behalf of the Social Survey section of the Central Office of Information, at the request of the Department of Scientific and Industrial Research, to provide information for the Building Research Station. Among persons living in postwar local authority dwellings, 1,843 persons were interviewed. In a further control sample covering all types of dwelling (including privately owned property) over 1,200 persons were interviewed.

According to the survey, nearly one family in every four occupying dwellings built since the war by local authorities are dissatisfied with their heating arrangements, and 5 per cent of the families questioned said that their bills for coal, smokeless fuels, gas, and electricity were too high.

There was a greater degree of dissatisfaction among housewives with ranges or solid fuel cookers in their main living rooms than among those with ordinary or improved open fires. In the kitchen 20 per cent of the households with solid-fuel cookers expressed dissatisfaction—chiefly on grounds of age and inadequacy—compared with 9 per cent in the case of those with electric cookers and 7 per cent for those with gas cookers. For the gas cookers the two main complaints were dirtiness and expense, and for electric cookers expense and slowness.

Dealing with water heating, the survey showed that a piped hot-water supply from outside the dwelling produced the highest proportion of pleased housewives. The next most popular arrangement was an efficient back boiler (behind a fire), which could be used in winter, combined with an immersion heater for use in the summer.

Other interesting points which emerged were that only one-eighth of improved open fires are kept burning overnight, and that 79 per cent of families had no oil stove, 83 per cent had no gas fires, and 48 per cent had no electric fire.

"Operation Chimney Plumes"

Power Station Chimney Gases in Fog

The accumulation of pollution in the air during fog is usually due to the fog lying under a temperature inversion layer—it is in effect held down by a mass of warmer air above it. Smoke and gases from chimneys rise in the normal way until they reach the ceiling which marks the boundary between the warmer air below and the colder air above. Without sufficient buoyancy, given by temperature and initial velocity, the smoke and gases fail to penetrate the ceiling and thus accumulate below it. It has been suggested that the emissions from modern electricity generating stations do possess sufficient buoyancy to force them up through the inversion ceiling, and that once through this barrier they will disperse harmlessly in the upper atmosphere. If this does occur the effects of the emissions may well be less than the effects of the residual pollution after washing the gases, when they are emitted in a colder, moister condition and are unable to break through the inversion ceiling.

To determine whether the flue gases are in fact able to make the breakthrough has been the purpose of an interesting investigation made by the Research Department of Fairey Aviation Surveys Ltd. for the Central Electricity Generating Board. In brief, the investigation was to send up a plane over power stations during a fog and observe what actually happened.

The first discussions on this project were held in September 1957, with the purpose of operating during the winter of 1957-8. Although the plans were laid on this basis, and the technicians involved stood by on a number of times during the winter of 1957-8, the right conditions did not arise before the operation was called off at the end of March 1958.

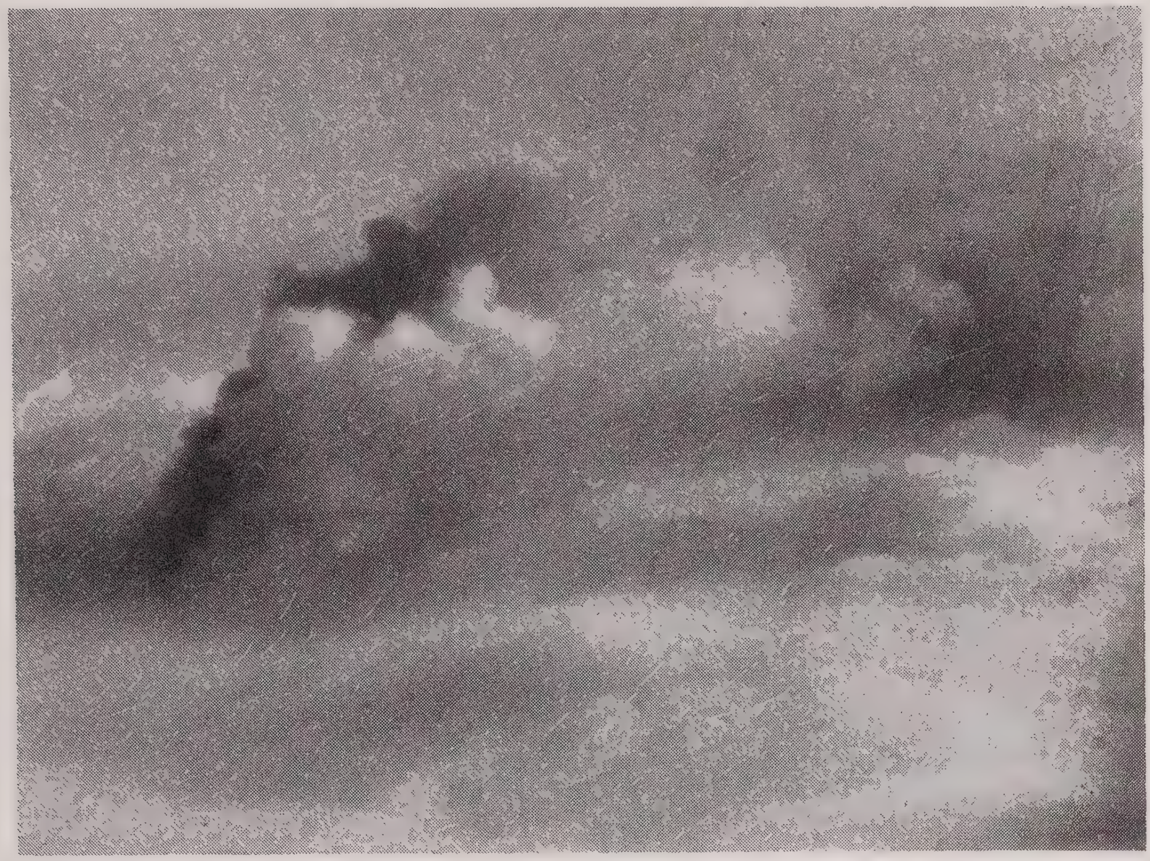
The operation was brought back to readiness in October this year, one flight in medium fog being made on October 28th, and another during the persistant fog of Thursday, 4th December.

The planning of the operation presented a number of problems. Firstly, adequate warning for the considerable number of people involved in the operation; secondly, a reasonable chance of being able to get the aircraft airborne and over the London area; thirdly, exceptionally accurate location of the power stations and navigation of the aircraft to bring it over them; and lastly good two-way communication between the aircraft and the power stations to co-ordinate the various actions that had to be taken during the operation.

Arrangements were made with the Meteorological Office that the L.A.P. Met. Office under Mr. Cumming, the senior Met. Officer, should issue special fog warnings during the afternoon preceding any morning when conditions of persistant fog were expected. For technical reasons it was considered that approximately 9 a.m. would be the best time at which to begin observations over the power stations. Therefore on receipt of this warning the operation was brought to a stand-by state in readiness for the next morning.

The aircraft to be used, a DC-3, is normally based at White Waltham, near Maidenhead, but if the expected fog materialised, it would obviously be difficult to operate from this airfield. At first it was felt that on receipt of the warning the aircraft should be moved to an airfield expected to be fog-free next morning, but this could have meant Scotland or the Continent. Therefore it was decided to move the aircraft to London Airport and accept a take-off under very poor visibility conditions.

The aircraft was fitted with the Decca Navigator and Flight Log. The Decca Navigator Co. Ltd. prepared special very large scale Flight Log charts



Coloured smoke penetrating the fog layer from Brunswick Wharf. Chimney height: 300 *ft. Height of fog layer:* 750-800 *ft.*

giving the positions of the power stations. Such was the scale that even separate chimneys at the individual stations could be plotted apart.

A separate V.H.F. transmitter-receiver distinct from the normal aircraft radio, and working on the C.E.G.B. communications frequency was installed and worked direct with a radio centre set up at the main power station.

On 3rd December a warning of persistent fog was received and the operation was brought to a full state of readiness. The aircraft was moved to London Airport, the crew accommodated in a nearby hotel and the power stations alerted. The aircraft was airborne at 08.45 hrs. on the 4th December, the take-off being made with about 50 yards forward visibility. The aircraft came out of the top of the fog into clear sunlight and proceeded to position itself over the group of power stations concerned using Decca. A number of plumes were seen penetrating the fog layer, and these were soon identified as belonging to various power stations.

The positive buoyancy of the plumes was proved by the turbulence the aircraft encountered when passing immediately above, but not in, a plume. After the initial identifications, experiments were made by colouring the gases. From Brunswick Wharf, a modern station with two tall chimneys, the efflux gases from one stack were coloured black and from the other stack red. The two coloured plumes were seen emerging side by side from the top of the fog.

Except when operating at higher altitudes, the aircraft had to remain within a circle of 3 nautical miles radius centred on Blackwall Point. The aircraft was kept within this circle using Decca, and particular attention was given to the power stations at West Ham, Blackwall Point and Brunswick Wharf. Oblique photographs were taken of the plumes from these power

The top of Crystal Palace television tower clear of the fog layer

stations as they broke through the top of the fog layer. Notes were also made of the characteristics of the plumes from visual observations. Records were made of the air temperatures throughout the climb from take-off and at various heights above the target area.

On completion of the operation over the power stations the aircraft made a dummy approach to London Airport, but found that the fog there was such that landing was impracticable. At the time of take-off the nearest airport open was Southend, but by now this was also out. The aircraft was therefore diverted to the nearest safe airport, Guernsey, and returned to London Airport next day.

Measurements of gas temperatures, ambient air temperatures, etc., were made at the power stations during operation, and these, together with the aircraft records will provide vital information for analysis. However, it is possible now to confirm that the chimney plumes do penetrate the fog layer and discharge into the upper atmosphere.

Prat-Daniels

Prat-Daniels (Stroud) Ltd. of Whitecroft, Nailsworth, Stroud, Glos., makers of fans and grit and dust collectors, advise us that they have moved from their London office at Westminster Palace Gardens, S.W.1. The London office of the Daniels Group, which includes T. H. & J. Daniels Ltd., British Boiler Accessories Ltd., and Prat-Daniels (Stroud) Ltd., is now situated at 62-3 Fenchurch Street, London, E.C.3 (Tel.: Royal 4122/6305). Mr. A. O. R. Johnson, Managing Director of T. H. & J. Daniels Ltd. has joined the Board of Prat-Daniels (Stroud) Ltd.

Smokeless Fuels and Zones

Debate in the Commons

IN a debate on the adjournment on February 12th, 1959, Mr. Norman Dodds (Erith and Crayford) raised the question of smokeless fuel production and distribution. We give extracts from his speech and from the Government reply by the Paymaster-General, Mr. Reginald Maudling.

Mr. Dodds said: I claim that in raising the problem of smokeless fuel and smokeless zones tonight I am raising a matter of widespread public interest that is becoming a more and more important aspect of our national life in which, I claim, the people are ready to play their part in a special effort to rid the atmosphere of smoke that is so damaging to the health and happiness of every man, woman and child. All of us appreciate the importance of seeing that the Clean Air Act works, but in view of the unsatisfactory situation that has for so long prevailed and seems to worsen rather than to improve, many people are wondering if all that could be done by the responsible authorities is being done.

I go further and say that my experience of the smokeless fuel mystery is the cause of more irritation amongst the public than almost anything else, and there seems to be a lack of confidence that those who handle these affairs are capable of dealing satisfactorily with the problem. There is a belief that in Government circles far too little has been done to ensure that the situation improves in respect of the supply of suitable types of smokeless fuel. In that respect it is felt when the matter is raised on the Floor of the House the attitude of Ministers is that they cannot care less.

Great attention has been paid in recent years to the official statements—particularly to those contained in answers to Parliamentary Questions put in this House—that there are ample supplies of smokeless fuel available. That has often resulted in members of the public not placing their orders for fresh supplies until they are almost out of fuel, only to be told that they will have to wait many weeks before they can obtain a supply. . . .

I think that many of the answers which have been made by Ministers have been misleading and, if they are not, then there is not sufficient information given to the public to enable them to take advantage of these ample supplies about which the Ministers talk so glibly.

In many cases people have been forced to buy brands of smokeless fuel that are available. They have found that to purchase them is a sheer waste of money, and this has caused a good deal of irritation and dissatisfaction.

As a result of complaints to the Ministry, an official was sent to see some of my constituents who were complaining, and the best advice that he could give them was that they should order their supplies about three weeks in advance of their requirements. This advice was given at a time which was not during the worst part of the year from the point of view of fuel consumption, and advice of that kind is not good enough. In recent weeks my constituents have received cards from their coal merchants stating that there is a delay in the delivery of smokeless fuels of approximately eight weeks, which does not present a very pleasant prospect. . . .

Day after day there are letters in the newspapers from people criticizing the smokeless fuel policy, yet never do I see a letter from a responsible source to put the complainants right if they are wrong. This is in sharp contrast, in the national and local newspapers, to the complaints made about the London Passenger Transport Board. One often sees letters in the newspapers dealing with these matters from the public relations officer's department in the Transport Board.

There is something very sadly lacking in this business of trying to transfer to clean air zones and to persuade the public to use smokeless fuel, as we all wish it to do. It is possible that the public needs education, and there is plenty of evidence to indicate that that is so. The public needs education in the right sort of fuel appliances which will give the best results. There are many other aspects of this problem. Why is not more being done in this respect? I speak as an ex-publicity manager. The public relations aspect of this matter is appalling, and the sooner someone takes action the better it will be.

" Warmco "

The National Coal Board a few weeks ago brought out a smokeless fuel which, I am assured by the top experts in the distributive trade, is as good as Coalite. That was a remarkable find. It was called " Derbylite " and the name hit the highlights. Now we find that the Board of Trade has some objection to that name on registration grounds and the fuel is likely to be called " Warmco ". Why on earth was that not found out before? Any businessman would know that this sort of thing is not good enough and someone would have been sacked in private trade. Why did this blunder take place? It does not help but adds to the chaos among the public.

I have discussed this with leaders in the distributive trade and with other knowledgeable people. There is a great need for the Government to call a conference where the people who manufacture smokeless fuels and those who manufacture appliances, grates and stoves, should get down to the job of co-operation and co-ordination in order to bring out some information which could be got over to the public in a dynamic way so that the public would be educated and when they used smokeless fuel it would be used with grates which give the best results.

I believe gas coke must be carefully selected to give satisfactory results. Much more needs to be done in research. If anything is done, could we have some information about it? Far too little is known by the long-suffering public. There is a feeling that the Gas Council is too cumbersome and works much too slowly. When ideas are put up to it there seems to be no reply to the people putting forward the ideas. There is a feeling that the Gas Council needs to be shaken up quite a lot. I understand that the Coal Board has stocks of smokeless fuel underground—what is called " Phurnacite " — totalling 120,000 tons. Many towns want it, but there seems to be some problem about distribution. Is it possible that more could be done so that this fuel which is suitable for closed stoves and gives satisfaction can be made more available to the public?

I understand that 3·8 million tons of hard coke is in stock and the main producer of coke for domestic fires, the Gas Council, I understand has stocks of 2·5 million tons. This is an appalling situation and shows that a lot has to be done in this matter.

I believe that in a few years' time gas coke will hit the highlights and will fill the bill, but people would like to know what is being done in the meantime to see that they get the right sort of gas coke and the right kind of appliances. More should be done by the Gas Council. . . .

I believe that all the evidence shows the great need for the manufacturers of domestic fuel and space-heating appliances to get together with the producers of smokeless fuels to secure co-ordination and co-operation in order to clear up these chaotic conditions of long standing and to give the public and local authorities a much better deal in this so-called march of progress. When these interests have hammered out a policy which makes sense, there will then be a need for a great improvement in public relations to educate and advise the public, not in a hole-in-the-corner and sketchy manner, as is now the case, but in a way which matches the vitally important part all this plays in the life of the nation.

The Paymaster-General (Mr. Reginald Maudling): I in no way disagree with the hon. Member for Erith and Crayford (Mr. Dodds) that this is an important matter needing close attention, and I can assure him that as a result of Parliamentary Questions and other activities with which the hon. Member is familiar, my noble Friend the Minister of Power is studying it very closely at present.

I ask the hon. Member, however, not to underestimate the amount which has already been done. I should like to say a little on behalf of the Minister about the problem with which he is primarily concerned—the supply of smokeless fuels. As the hon. Member knows very well, the basis of the Clean Air Act was the Beaver Report, which estimated that the additional supplies of solid smokeless fuel which would be needed over the period of application of the Clean Air Act would be about eight million tons suitable for use on open grates. They made it quite clear, after considering all the premium fuels and the other sources, that a large proportion of the eight million tons would need to be gas coke. We must start with that assumption.

The suppliers of the premium fuels with branded names have been making considerable efforts to expand their production, and they have been making a good deal of progress. The limitation in the case of the manufacture of premium fuels is two-fold. Firstly, there is the limitation of the capacity of the plant. Secondly, there is the difficulty of getting adequate supplies of coal of the rather special qualities which I understand are necessary for making these premium fuels. Within the limits that are imposed by these two factors, I am sure that production will continue to rise in order to meet the brisk demand.

The National Coal Board and the Gas Council have been doing a great deal in this field. The hon. Member referred to the new product of the National Coal Board, now to be known as " Warmco." I am glad to hear that he has been told that this is to be a very good product. We believe that it will be. The output is now starting at an annual rate of over 160,000 tons. That will make a very large contribution to the problem. If demand warranted the effort, the Board thinks that it could turn over some of its other coke oven capacity at reasonably short notice to increase this output.

Research

The Coal Board has been doing much research and development work on other processes, which show promise of yielding new types of fuel. There have been problems. Progress has not been so fast as we wished, because it is a very difficult technical problem to get a proper binder to convert small coals into smokeless fuels suitable for burning in a domestic grate. It would be wrong to underestimate what has been done. The Coal Board will press on even more vigorously with its research and development in this field, and it will have the full support of my noble Friend the Minister of Power.

I come to the main problem, which I think is the problem of open grate gas coke. Much of the coke now sold is a good quality open grate fuel which has been used for many years by many consumers up and down the country, but this quality of coke is not always available as such. When the Beaver Committee talked about coke, it said clearly that it meant a high quality free-burning fuel. It recommended that the British Standards Institution should prepare specifications and the gas boards and other producers of coke should supply coke to those standards. The preparation of a British Standards specification for domestic coke is well advanced, and the area gas boards have introduced a draft specification at more than 40 gas works. The purpose of this is to avoid the marketing of unsuitable coke as open fire fuel, to improve the consistency of the deliveries to consumers and to make available what has always been proved to be a suitable gas coke for this purpose.

I think that is one of the main contributions that the gas boards can make to the supply of gas coke suitable for use on open grates. The gas boards are also discussing with the coke distributors improvements in the existing marketing arrangements, which will be designed to ensure that consumers who order open fire coke can receive coke of a consistent quality. I think that that will show the hon. Gentleman that, although we cannot satisfy him, we are not entirely motionless and that progress will be made. It is well recognized that providing gas coke of the proper quality and ensuring that consumers can buy that quality for the purpose for which it is intended is probably the most important contribution to the problem. Coke of this quality can be obtained in fairly large quantities. If public demand warrants it, I understand that it should very soon be possible to make available some three million tons a year of these qualities. I understand, also, that this quantity could be increased, if required, to five million tons or more. That will be a very substantial contribution.

Publicity

The hon. Gentleman's other point referred to publicity and to advising the public. I did not realise that he was an ex-public relations officer, although I might have guessed, and I was very interested in what he had to say on this professionally, as well as from a constituency point of view. We accept that more should, and will be done to inform the public. I understand that leaflets are now being issued to the distributors by quite a number of bodies—the gas boards and the Solid Smokeless Fuels Federation. The gas industry is carrying out increasing publicity work on the merits of coke, and engaging in what are called educational activities amongst consumers. This work is mainly directed to the consumers and coke merchants, but the aim, also, is to give service to local authorities and others interested.

I am informed by my hon. Friend the Parliamentary Secretary to the Ministry of Housing and Local Government that in the near future it is intended to issue a leaflet to all householders in smoke-control areas which will explain to them what is involved, and will give them advice on what they should do. I think that that will fill a need that is recognized, and to which the hon. Gentleman has called attention on more than one occasion.

In answering this brief Adjournment debate, I have tried to show that in carrying out the clean air policy—which we all want to carry out—the Government recognize that there are two serious problems; the availability of solid smokeless fuels, and information to the public as to how to obtain them and how to use them. The fuels necessary are available in total quantity, if we include gas coke—because there is plenty of it—and that may be included as long as we can justify ourselves in saying that the gas coke available is of suitable quality, and may be obtained by the public on that basis.

Those are the lines on which we are endeavouring to pursue this matter. We shall continue our efforts with vigour, pursued, in our turn, I have no doubt, by the hon. Gentleman.

Questions in the House

Smokeless Fuels

Mr. Mason asked the Paymaster-General if he will give general directions to the National Coal Board to produce a smokeless fuel, of a quality which will pass the Clean Air Act and be allowed in smokeless zones, out of the large stocks of unsaleable small coal.

Sir I. Horobin: No. The National Coal Board is already working on a number of possible methods of making smokeless solid fuels from suitable small coals but the technical problems are not yet solved. Meanwhile, there is no shortage of smokeless fuels to meet the requirements of the Clean Air Act. (8th December, 1958.)

Motor Vehicles (Smoke)

Mr. Russell asked the Secretary of State for the Home Department how many prosecutions or warnings have been given in the Metropolitan Police district in recent months for the emission of smoke from vehicles with diesel engines; and if he will arrange for such offences to be recorded separately in the Return of Offences Relating to Motor Vehicles.

Mr. Renton: During the twelve months ended 30th September, 1958, 73 persons were prosecuted and 77 persons received written warnings for offences committed in the Metropolitan Police District against the Regulation which makes it an offence in certain circumstances to use a motor vehicle which emits smoke. I regret that no separate figures are available relating to vehicles with diesel engines. Much additional work would be required if these offences were to be recorded separately in the Return of Offences Relating to Motor Vehicles, and my right hon. Friend does not think this would be justified. (11th December, 1958.)

Smokeless Zones

Mr. Dodds asked the Minister of Housing and Local Government and Minister for Welsh Affairs in how many instances in which his approval has been sought to create smokeless zones he has caused an inquiry to be made to ascertain that the supply of smokeless fuel would be adequate for the need; and in how many instances he has withheld approval because of inadequate supplies.

Mr. Bevins: Inquiries are made in every case. In no instance has my right hon. Friend had to withhold approval. (20th January, 1959.)

Smokeless Fuels

Mr. Dodds asked the Paymaster-General (1) if he is aware of the increasing difficulty experienced by the public in trying to obtain supplies of the appropriate types of smokeless fuel; what co-ordination there is between his Department and the other authorities concerned with creating smokeless zones; and what machinery exists to relate this policy to the adequacy of supplies of the kind of fuel necessary to give satisfactory results in modern domestic solid fuel appliances; and

(2) if he is aware of the widespread dissatisfaction during the recent cold spell in respect of the renewed inadequacy of supplies of suitable types of smokeless fuel for modern domestic appliances; and, in view of the many assurances that have been given over the past few years that steps were being taken to improve the position, if he will make a statement explaining why the position now continues to worsen, and give some indication of how much longer the present unsatisfactory situation is to continue.

Mr. Beswick asked the Paymaster-General if he is aware of the consumer resistance to the use of coke as a smokeless fuel and the inadequacy of the supply of alternative smokeless fuels; and if, in view of the Government's clean-air policy, he will investigate the alleged unsuitability of coke and, if necessary, increase the supply of other types of smokeless fuel.

The Paymaster-General (Mr. Reginald Maudling): There has been a substantial increase in demand for solid smokeless fuels, much of it in districts not covered by smoke control Orders. There is no overall shortage, although supplies of certain premium fuels are limited. There are ample supplies of gasworks and coke oven coke, which, used in the right appliances, will burn well. Where there is resistance to the use of coke this arises largely because consumers use unsuitable qualities or burn it in unsuitable appliances without always realising that it needs to be used differently from coal. Householders who are not used to coke can get advice on how to use it from their local Gas Boards or coke distributors.

Local authorities proposing to set up smoke control areas are required to estimate the smokeless fuels needed. These estimates are examined by regional committees on which producers and distributors are represented, and on the basis of their work, my noble friend the Minister of Power advises my right hon. Friend the Minister of Housing and Local Government on the adequacy of supplies.

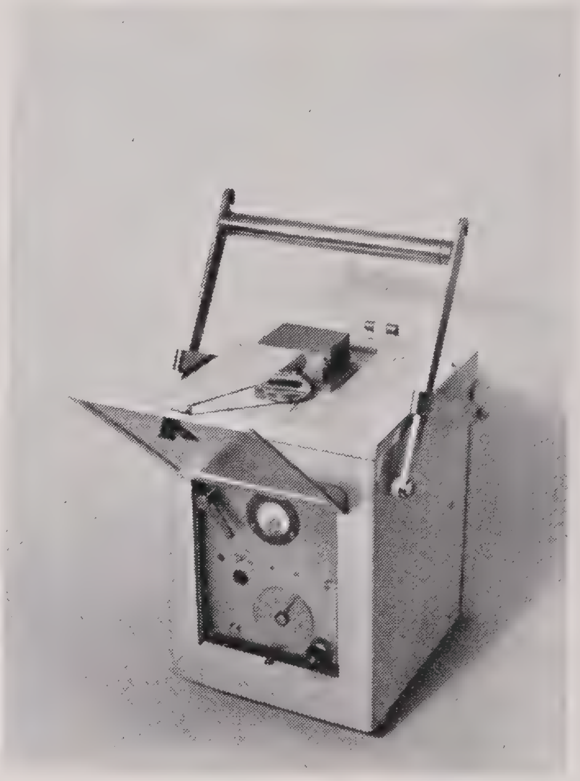
Mr. Mayhew asked the Paymaster-General what action he is taking to increase the output of manufactured smokeless fuels.

Mr. Neal asked the Paymaster-General if binderless briquettes are now being marketed through normal trade channels; and if he will make a statement.

Mr. Maudling: The manufacturers of smokeless fuels are continually increasing their output to meet the demands for their products. The National Coal Board is working on a number of possible methods of producing new types of smokeless fuels, including the production of binderless briquettes, but there are still a number of problems to be solved.

Mr. Bottomley asked the Paymaster-General why there is a continuing shortage of smokeless fuel in Rochester and Chatham, in view of the Government's clean air policy.

Mr. Maudling: There has been a general increase in demand for solid smokeless fuels, not only in Rochester and Chatham. While certain premium fuels are in limited supply, there is plenty of gasworks and coke oven coke, which burns well when used in the right appliances. Householders who are not used to coke can get advice on how to use it from their local gas boards or coke distributors. (2nd February, 1959.)



DUST SAMPLER

We illustrate above a Dust Sampler manufactured by W. Ottway & Co. Ltd., of Northfield Avenue, Ealing, London, W.13. It is intended primarily for dust sampling in coal mines, but could be used for other special surveys and investigations. It is known as the "long-running thermal precipitator" and has been designed to operate over periods of up to eight hours. Only the respirable dust, which is selected aerodynamically from the total airborne cloud during the sampling process, is collected. The instrument collects the dust by a combination of gravity settlement and thermal precipitation. This method avoids the weaknesses of both the conventional thermal precipitator and the simple sedimentation sampler, and makes use of their advantages. The evaluation of samples is normally carried out by visual microscopy.

CLEAN AIR ACT CASES

C.A.A., Section 1—Black Smoke from Steelworks

On 2nd December, 1958, the English Steel Corporation, Limited, of Sheffield, were fined £20 by the Sheffield Magistrates' Court, for a breach of the Clean Air Act. The firm pleaded Guilty to allowing black smoke to be emitted from its heat-treatment boiler plant at Grimesthorpe for more than two minutes in a half-hour period.

Mr. Peter Jackson, for the firm, criticised the way in which the prosecution had arisen. He said English Steel had done everything in its power to avoid polluting the atmosphere. It had spent upwards of £1,500,000 on equipment for this purpose.

The reported incident had been an isolated one, but information was not laid nor a summons served until four months after the report. The firm, he said, had given all possible co-operation to the authorities over the Clean Air Act and expected " a little more in return than it had received."

Section 1—Black Smoke from Laundry

The Undercliffe Laundry were fined £5 at Bradford on each of two offences of emitting black smoke for more than two minutes in a 30-minute period. The company pleaded Guilty.

Prosecuting, Mr. Keith Lomas said that when the city's senior smoke inspector saw the boiler at the laundry it was in a " pretty poor state " and rain could enter the boilerhouse.

Mr. D. A. V. Joyce, for the laundry, said that it was in " a struggling way of business, hard hit by the home laundries." In spite of that, they had spent more than £1,000 to try to comply with the regulations. The offences were caused by faulty stoking.

Section 1—Black Smoke from Steelworks

Before the Sheffield magistrates the firm of Woodhouse and Rixson Limited, makers of steel forgings, etc., pleaded Guilty to allowing an emission of black smoke for more than two minutes in a half-hour period from its Attercliffe works. It was stated that the company was so keen to comply with the provisions of the Clean Air Act that it pays its boilerman a bonus if no complaints are received. The prosecution, the first brought against the firm, resulted in a fine of £10.

Section 20—Black Smoke from a Ship

Clan Line Steamers were fined £25 with 10 guineas costs at Grays, Essex, on 17th January, 1959. A summons accused them of excessive emission of black smoke from their cargo ship *Clan Mackinlay*, 7,000 tons, at Tilbury Docks on October 2nd.

The chairman of the magistrates, Mr. E. Benton, said " We feel there were extenuating circumstances," after being told on behalf of the owners that a check valve cover joint blew out creating a situation of danger with high pressure steam escaping. The engineers, it was stated, had to " flash up " a fresh boiler, and burning cold oil caused the black smoke.

The defendants pleaded Guilty.

Mr. C. J. Thackery, for the prosecution, said that a police sergeant saw a large amount of black smoke hanging over Tilbury near the docks at 6.15 p.m. and described it as like a thick fog. " He formed the impression there was a large fire there. The atmosphere was filled with black, oily soot smuts." The smoke was continuous until 7.15 p.m., apart from once easing for about three minutes.

The police received thirty-one complaints by occupiers in the neighbourhood. The smoke descended on clean linen, on a man painting his house, and penetrated into houses. The police sergeant saw the chief engineer who said that at 6.15 p.m. he heard steam escaping in the engine room. He knew something was wrong and, going to the engine room, found the main feed valve in the donkey boiler had blown out. This made it necessary to shut the boiler down and raise steam in another boiler. " When this is done excessive smoke is caused until the oil has warmed up."

Mr. J. F. Willmer, for the owners, expressed their regret. When the check valve blew out the level of the water in the boiler being used as " donkey " fell dangerously and steam and water under considerable pressure escaped into the engine room. A new boiler had to be set light to and because the oil was cold there would be incomplete combustion.

The engineer was concentrating on the emergency and conversing under these conditions was difficult. It was under these conditions that the forced draught to produce proper combustion had not been adjusted as perhaps it could have been.

The case was brought by the City of London Corporation who are the public health authority for the Port of London.

Section 1—Dark Smoke Prosecutions

Two industrial firms were fined at the Birmingham Magistrates Court on 23rd January, 1959, for the emission of dark smoke in contravention of the Dark Smoke (Permitted Periods) Regulations, 1958.

In one case the firm pleaded Guilty to a summons alleging the continuous emission of dark smoke of twelve and a half minutes duration from the chimney of a vertical boiler, and on the case being proved, were fined £15. It was stated in evidence that the smoke was caused by the burning of unsuitable material in the furnace.

The other firm pleaded that though the emission of dark smoke of fourteen minutes duration from a chimney serving two Lancashire boilers with sprinkler type stokers, was not denied, it had been caused by extenuating circumstances. After hearing the evidence the magistrate found the case proved and a fine of £25 was imposed.

Section 1—Black Smoke from Laundry

For permitting black smoke to be emitted from the chimney at their Broadstone Hall Road South, Reddish, laundry, for a period of three-and-a-half minutes, Hyde and District Co-operative Laundries Association Ltd. was fined £5 at Stockport Court. It was the first case of its kind in Stockport under the Clean Air Act, said the magistrate's clerk.

Prosecuting, Mr. G. J. Turner said that new fire bars had been delivered at the laundry the previous day and this was an attempt by the firm to stop the black smoke. But the local authority's submission was that the dark smoke could have been minimized by careful use of the furnaces.

Section 1—Black Smoke from Oil-fired Boiler

A firm was fined at the Birmingham Magistrates Court on 30th January, 1959, for the emission of black smoke from an oil-fired boiler.

The defendants pleaded guilty to a summons alleging the continuous emission of black smoke of eleven minutes duration from the chimney of an oil-fired Cochran boiler, and on the case being proved, were fined £10. It was stated in evidence that there was an excessive build-up of carbon deposits around the oil burner which interfered with the spraying of the fuel oil into the furnace.

Section 1—Black Smoke from Melting Furnace

At Birmingham Magistrates Court on 30th January, 1959, the partners of a non-ferrous metal refining business pleaded guilty to a summons alleging two emissions of black smoke totalling thirteen minutes in thirty minutes from a chimney serving a pit-fired melting furnace. It was stated in evidence that the emissions of black smoke were caused by the burning of rubber-covered cable in a crucible pot for the melting of non-ferrous scrap metal. The case was proved and a fine of £5 on each of the two partners in the business was imposed.

Review

Colour Filmstrips on Air Pollution

Two filmstrips in colour have just been published, and we welcome the opportunity of drawing attention to them. " A " is entitled " The Nature, Production and Effects of Air Pollution," and " B " is " The Dispersion and Accumulation of Air Pollution: Behaviour and Appearance of Smoke." They have been produced by Diana Wyllie, and with them goes an explanatory book of notes by Dr. R. S. Scorer. The two strips, together with the book are issued by Diana Wyllie Ltd., 18 Pont Street, London, S.W.1, and cost £4 complete.

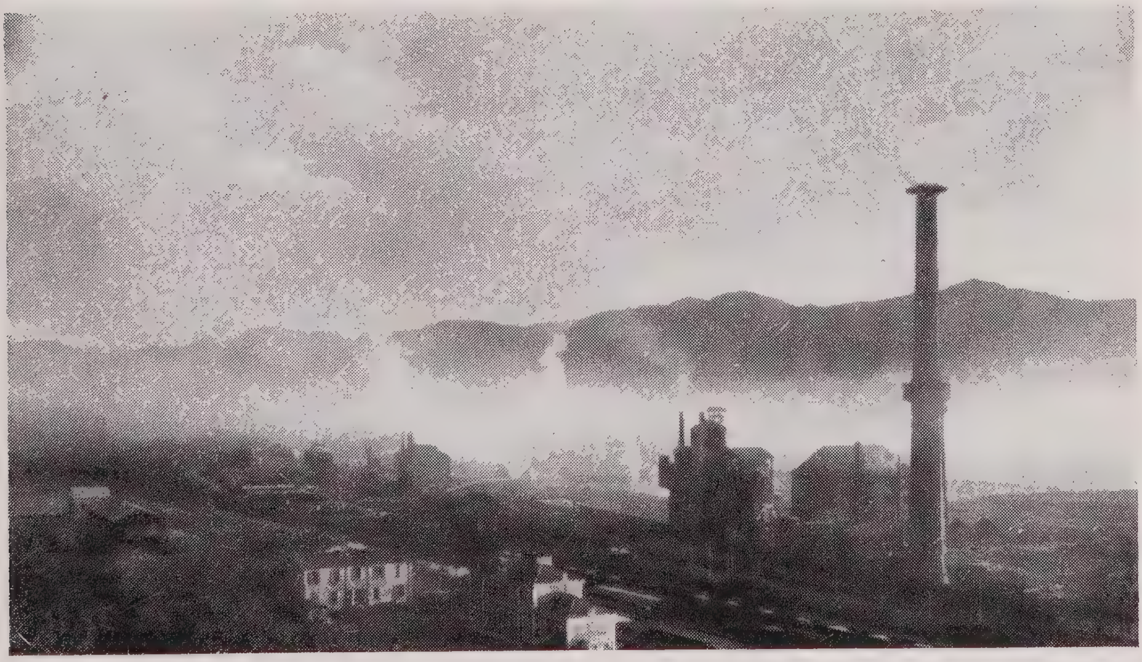
Either, or both, of these two filmstrips, backed by the full notes by Dr. Scorer, will provide material for a lecture on some of the scientific aspects of air pollution that can be full of interest—much of course depending on the lecturer—to any intelligent audience. The lecture could range from the popular semi-scientific to a much longer and fully scientific discourse. The photographs are excellent both in subject matter and their colour quality—a factor that adds to their interest in this particular subject, where colour photography has so far been little used. There are also a number of colour diagrams. Dr. Scorer himself is responsible for many of the photographs and others have been secured from various parts of the world.

The accompanying notes, to which Sir Hugh Beaver contributes an encouraging foreword, are in much more detail than is often the case with filmstrips, and they are indeed indispensable for an understanding of many of the illustrations.

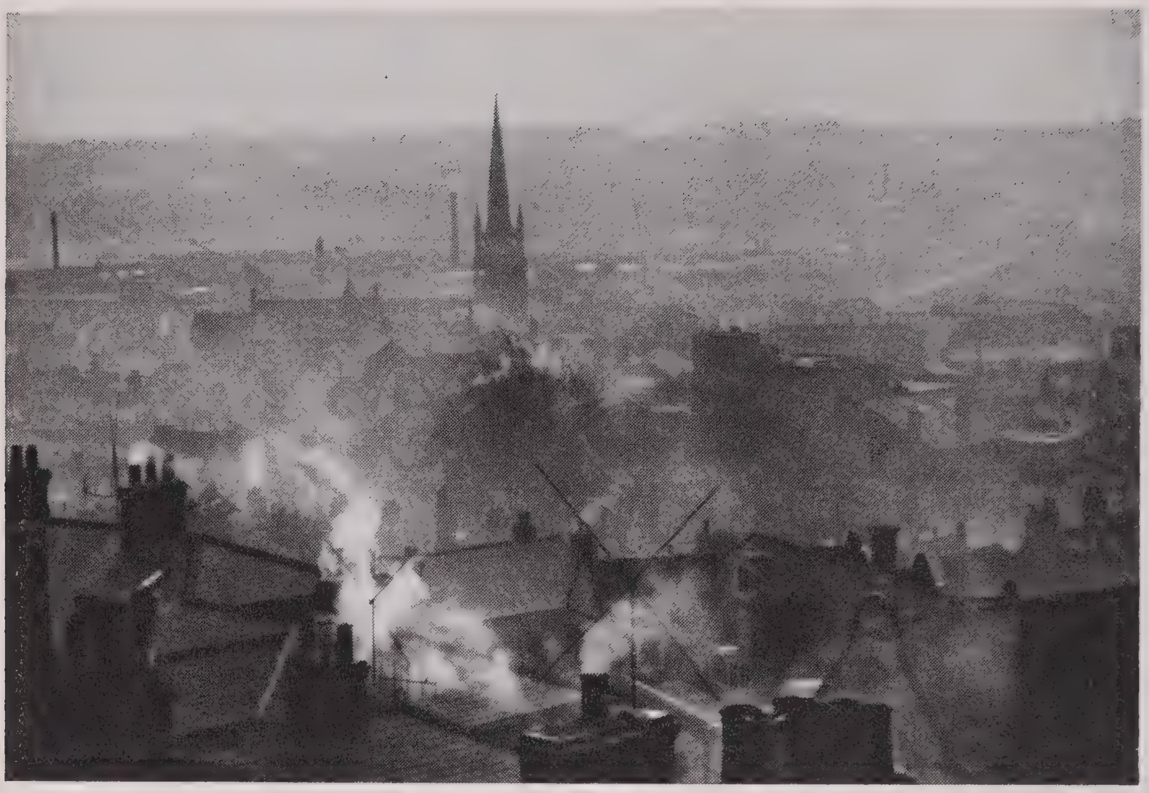
We reproduce black and white versions of two of the photographs from strip " B " and to show how they are annotated in the printed booklet quote their descriptions.

For that called " Inversion in an Alpine Valley " the note reads:

> At night air made cold by proximity to the cold ground runs down the hillsides and fills the valley bottoms with pools of cold air on occasions when there is no general movement of the air. At this aluminium works in the valley of the Durance (Basses Alpes) the accumulation of a night is seen soon after sunrise in January. The plumes from the warmer sources rise through the main body of smoke



Inversion in an Alpine Valley—from the Filmstrip



Pollution in Streets—from the Filmstrip

> on account of their buoyancy, and that from the tall chimney is emitted above it. Nevertheless even these do not rise very far because the air is stable up to above the tops of the mountains. Note the disc at the chimney top which is used to avoid downwash. The chimney is also used to support a water tank halfway up.

The other photograph, " Pollution in Streets " is described as follows:

> This photograph taken in Lincoln in similar weather to the last picture (of Edinburgh) shows how domestic smoke (which is seen as bluish against a dark background except when the density is large) is carried passively by the eddies down into the streets before there can be much dilution. The smoke does not rise upwards from the chimneys, except when the surrounding air is almost calm, but follows the track of the air because of the low heat content of the effluent. Smoke from smaller or low-lying houses enters the windows of taller or more highly situated ones. It also enters the backyards of the houses emitting it.

The strips do not deal with the remedies for air pollution, nor with its measurement. At the end of the second strip Dr. Scorer introduces his controversial calculations on the relative damage and costs due to pollution from different sources—in which for instance he shows that a ton of coal burned in a domestic fire does 2,000 times as much harm as a ton burned in a power station. It is, perhaps, just possible that he may be near the mark, but a lecturer other than himself may not find it easy to explain how these comparisons have been determined, and even less easy to defend them. But perhaps Dr. Scorer intends to be provocative—which is not too bad a thing.

Service

Timed to begin with a Clean Air Exhibition in Leicester, a city firm of coal merchants has started regular weekly deliveries of gas coke and other smokeless fuels to all major housing estates in Leicester. The vehicles which will be delivering this fuel will carry no coal and will be used entirely for the sale of smokeless fuels.—*Leicester Mercury.*

TECHNICAL DIFFICULTIES EXPERIENCED BY INDUSTRY IN COMPLYING WITH THE CLEAN AIR ACT AND REGULATIONS

Extracts from a Discussion before the Institute of Fuel, 22nd October 1958

THE chair was occupied by the President of the Institute of Fuel, Mr. T. C. Bailey, and the discussion was opened by Members of the Federation of British Industries' Air Pollution Panel. The speakers were: H. E. Hopthrow, C.B.E., Assistant Secretary, Imperial Chemical Industries, Limited; C. Machen, Fuel Engineering Consultant, T.I. (Group Services), Limited; J. Redman, Engineer Adviser, Federation of Master Cotton Spinners' Associations, Limited; Kenneth Marshall, Director, The Joint Iron Council; E. J. MacDonald, James Hodgkinson (Salford), Limited.

H. E. Hopthrow said that four or five years ago, when consideration of the subject began, he appointed himself unpaid smoke inspector during his frequent train journeys and set out to discover how many infractions he could see of what was now Section 1 of the Clean Air Act. He had seen so many that he had visualized himself conducting prosecutions on two or three days of every week! Since the Appointed Day, however, he had been almost out of a job, because there had been a sudden and rapid reduction in the emission of dark smoke. He had not seen a single infraction since that day.

In one of his recent reports Dr. Carter had referred to low-level discharges, no doubt having in mind the leaks from various chemical plants of gases which did not get to the flues. Mr. Hopthrow had a different point in mind—the habit in many works, not least the chemical industry, of dealing with small discharges by putting pipes through the roof and letting the discharge out in that way. In many works this amounted to a large number. These were untidy and they were bad psychologically, although he had no idea to what extent, technically, they caused pollution. It would cost very little to have better habits and to collect the effluent and discharge it where it could get away instead of hanging around the factory on damp days and days of inversion conditions.

In his Presidential Address to the National Society for Clean Air at Llandudno recently, Dr. Lessing had spoken about grit and dust, urging some method of measurement, and further research into this matter. Mr. Hopthrow had more in mind a method of rating the performance of dust and grit removal plants. Much was said about the efficiency of collection and nothing about what slipped through. There was nothing original in this thought—it had been mentioned in the Beaver Report—but it was more important to the purchaser of plant to know how much dust was passing out the chimney rather than how much was caught.

In a case he knew about there had been a strong complaint about dust nuisance. The engineers concerned had demonstrated to their management how efficient the plants were by reference to the tons per hour caught and prevented from passing up the chimney. As a result, the management had been reluctant to take any action—but the complaints had persisted. Eventually they were persuaded to convert the performance figures into how much came out of the chimney, actually a ton per hour. In less than a week the management were converted to the view that they must do something about it. No matter how efficient a plant is rated; 1 ton an hour from one plant in a residential district cannot be tolerated.

As the President had said, he had once been an engineer, although he had left engineering a long time ago. During the formative days of the Act he had visited a number of dust extraction plants and had been surprised and disappointed at the low standards of mechanical and electrical engineering applied to dust extraction plants. Few worked as originally designed and many of the failures had nothing to do with the fundamental physics of catching particles but were due to simple mechanical and electrical engineering problems which should have been solved long before. In an area with a dust problem, there was nothing worse, psychologically, than to have the promise of a good future, signs of achieving it and then, suddenly, a plant breakdown. He pleaded for better standards in the mechanical and electrical engineering of dust plant.

C. Machen said that when he began to consider the subject with which he had been asked to deal—hand-fired boilers and incinerators—he was struck by the thought that they were strange bedfellows. The first might be expected to be on the way out while the second, in a properly developed form, was likely to become an essential adjunct in every factory. They had some features in common, however; both were in a bad state of health from the aspect of the Clean Air Act and in many ways their symptoms were similar. Both were liable to pollute the atmosphere with smoke or smells or both. Their case histories suggested that both were suffering from retarded development. This condition was not due to any lack of know-how but to the reluctance of many people in the industry to apply the means available. It now appeared that the claims of people in these Islands to breathe clean air were effecting a change which the well-meaning efforts of the fuel technologist for many years had failed to bring about.

When people told him that the hand-fired boiler was a good boiler, he was reminded of Disraeli's remark about Gladstone—" that he was a good man in the worst sense of the word." A boiler might be a first-class example of the boiler-maker's skill, but without combustion arrangements which would ensure a good standard of efficiency and check the emission of smoke, it could not be a good boiler. Even if one were fortunate enough to find a skilled and conscientious boilerman, an artist with a shovel, it was impossible for him to follow the cyclic variations, of volatile emission, fuel bed thickness and other factors and to make the necessary air adjustments and distribution to give optimum efficiencies such as any good mechanical stoker would give all day long.

In any event, this sort of labour was out of tune with present conditions. The hand-fired boiler in these days was an anachronism as much as was a motor-car without an efficient carburettor. One of these days, if hand-fired boilers were still in existence, they would be regarded as museum pieces or skeletons in the cupboard.

And now he had to confess to having found some skeletons in his own cupboard. Among the 100 or more steam boilers operated by the Group which he served, he had found four hand-fired boilers. Two were Lancashire boilers working on semi-bituminous coal with 15 per cent. volatile matter. These were equipped with special grates and balanced draught. Although they were working on " through " coal—the wide variation in size of which was a difficulty—the boilers could with reasonable care be operated within the permitted period of smoke emission and density limits laid down in the Regulations, and no application for temporary exemption was necessary. During the last few weeks, however, after reviewing the economics of the boiler plant in the light of coal and labour costs, it had been decided on economic grounds to install mechanical stokers, and these were now being put in. These were in the South.

The other two hand-fired boilers in the Group were in the Midlands. Both were vertical boilers, about 2,000 lb./h. rating and fired with bituminous coal, of about 32 per cent. volatile matter. Owing to its compact design and relatively small combustion space the vertical boiler is a notorious " smoker." One of these boilers, attached to an expanding factory and usually loaded almost to capacity, threatened to give trouble, and application was made in May for a certificate of exemption, which was obtained, on the ground that in due course waste-heat boilers would provide the normal source. In spite of the exemption, the inspector was moved to protest. Since the boiler would eventually be retained as stand-by plant, it was decided to equip it with under-feed stoker at once. This has solved the problem.

The other vertical boiler carried a light load. Application for temporary exemption was made for this but, after he had called and had a chat with the fireman, the inspector said that exemption appeared not to be necessary and that the boiler was unlikely to cause offence. As the boiler was lightly loaded and the fireman was keen on his job, he was getting away with it by putting into practice the well-known firing trick, " little and often."

Turning to the wider aspect, Mr. Machen on his journeys had kept a watch for smoke emissions which might indicate hand-fired boilers but had drawn a blank.

He had telephoned the Chief Public Health Inspector of Birmingham, who had said that, due to the efforts of his Department in the past, the coming into force of the Regulations on June 1st found Birmingham in a unique position in the absence of hand-fired boilers. He had said that, because of the almost universal use of mechanical stokers or oil firing in the Birmingham area, it would be difficult for any of his inspectors to say of any district on any day of the week that they might expect to find an offender there. He had also pointed out that the City of Birmingham Smoke Control Order No. 1, 1958, specifically exempted mechanical stokers in the specified area, subject only to their being so maintained and operated as to minimize the emission of smoke.

Nor did incinerators in the Birmingham area appear to cause any embarrassment. It appeared that the smoke and smells by which they used to make their presence known were not much in evidence today. This opinion, too, had been confirmed by the Chief Inspector, who said that the position had much improved. There seemed no doubt that factories were using more care in disposing of their waste material and were probably improving their incinerators, too. In many cases this should not be a difficult job.

Formerly, the incinerator had appeared in many forms, ranging from a crudely designed brick-built affair to any corner of the factory area, where two brick walls formed a convenient angle, or sometimes to smouldering rubbish on open ground. This was now ruled out, because under the Act the incinerator was subject to the same restrictions for smoke, dust and grit as were boilers and furnaces.

Nor would it be easy to avoid the issue by burning rubbish in the open technically without a chimney, for this was covered by Section 16 as a smoke nuisance.

The difficulty with incinerators was the diverse nature of factory rubbish. If it were a homogeneous mixture it would be easier to deal with it. There was something to be said for mixing refuse thoroughly before incineration or dealing with widely varying types separately. In designing an incinerator to avoid smoke, the same principles applied as for burning volatiles in a boiler. There must be a means of controlling the rate of emission of volatiles by adjusting primary air. Then the gases must pass through a hot zone with extra air, as required, at such a temperature as would ensure complete combustion, i.e. at about 700°C. This hot zone must be independently heated by oil or gas until sufficient heat was generated by the burning refuse to maintain the temperature.

Pre-heated air was an asset. Refractory lining throughout would conserve the heat and reduce the amount of bought fuel needed. There were a number of well-designed and efficient incinerators on the market which would deal with every kind of factory refuse. One which he had inspected recently could be supplied with a catalyst unit in the hot zone in the form of a platinized ceramic grid. This equipment consumed the thick smoke from shredded rubber with no more than a slight haze at the chimney.

His experience was that industry seemed to have set itself out to meet the needs of the Clean Air Act. On the other side, the Public Health Inspectors seemed to be using the way of persuasion rather than the powers given to them in the Act. Between the two, the work was going along very happily and successfully.

J. Redman said that he would present as briefly as he could the full picture of the special difficulties experienced with banked fires; these were found especially in the textile industry, but others might experience similar difficulties where comparatively large steam demands were required in a relatively short time and where these comparatively large steam demands had to be met from boilers which had had banked fires for long or short periods, such as after a week-end, all night or during lunch-time.

The particular problems, which might be special to the textile industry—although others might have similar problems—were based on the fact that steam engines had to be started up to drive machinery in the factories. Any delay in starting up meant loss of production and every minute was therefore vital.

In the textile industry, Lancashire boilers were popular as steam generators because such boilers had a comparatively large steam reserve, and this reserve was of considerable advantage to meet the initial comparatively high steam demands made of them.

He emphasised that the whole or nearly the whole of the boiler plant steam output of textile factories, particularly where steam engines were installed, had to be available to start up, and rarely for economical reasons was extra boiler plant brought into service merely to cope with the starting periods, which were for a few minutes only.

This meant that the desired normal running horse-power for any particular factory must be attained at a given instant to start production in the factory. Consequently, the steam load from the boilers must be available and every effort had to be made to avoid smoke beyond Ringelmann 2. This called for careful operation by firemen and engineers. They had to apply a technique in the following way: the steam pressure of the boilers was allowed to fall a few pounds below the normal running pressure during the banking period to a predetermined level before the beginning of starting up operations. At a set time before start up, accelerating firing methods were applied to the boilers to synchronize the normal running pressures of the boilers with that of the initial start up of the engines. The engines were started without external load and were brought to speed, which took about two minutes or less. When the engines had attained full speed, which was at the factory starting time, the factory running loads or external engine loads were applied by factory workers when they started up their machinery. This took about five minutes. These applied external loads were more or less outside the control of the engineers and the boiler firemen.

These were the basic principles of the situation in which violation of the regulations of the Clean Air Act were liable to take place. Incidentally, the railway engine hauling the train on which he had travelled to London offered the fireman similar problems when starting from the station; the conditions were considerably worse than those he had described, because he had been covered with soot and grit after making his inquisitive observations from the carriage window.

Taking a more technical view of the problem of starting up from banked fires, it was possible to tabulate the conditions into two distinct sections of operations. Section 1 was the breaking up and levelling off of banked fires in readiness for the oncoming load. Section 2 was the accelerating of boiler firing methods to cope with the load.

This section he divided into three stages. The first stage was to bring the steam pressure up to normal working pressure from a predetermined lower level to synchronize full steam pressures with that of the initial start up of the engines. The second stage was to accelerate firing methods, and consequently boiler output, to cope with the steam demands of the engines coming up to speed without external load. The third stage was to intensify accelerating firing methods to cope with the full factory load.

Perfect Combustion

There were well-known conditions which must be present to enable perfect combustion to take place. For instance, there had to be adequate time for combustion to take place, both in a solid fuel bed and in the volatile matter. Secondly, the temperature must be sufficiently high for combustion to take place. Thirdly, adequate air supplies, in proper proportion, must be introduced at the right place.

It could be realized that one or even all three of these conditions could easily be missing when dealing with banked fires, with the result that unburnt volatiles would escape beyond the combustion chamber and appear as smoke at the chimney stack.

Amplifying the above Mr. Redman went on to explain that in the first section of the operations, where banked fires were being prepared and levelled off in readiness for the next stage of the operation, some of the raw material left on the fire during the banking periods might be mixed with the incandescent fuel when the breaking up and levelling off of the fuel beds took place. During this operation a comparatively large amount of volatiles might be liberated which would not be burnt off, as the fuel beds would at this stage be at too low a temperature. A proportion might therefore escape beyond the combustion chamber into the flues.

In addition, because of the thinness of the fuel beds, stratification might occur and prevent proper mixing of the right proportion of oxygen with the carbon. Tar and soot from cracked hydrocarbons entered the chimney stack via the flues, which might produce a certain degree of visible smoke at the chimney top because of the presence of carbon in the gases.

Experiments at one of the Association's factories had been carried out with perfect control of primary air and, in particular, of secondary air. The results had been encouraging in an effort to avoid making smoke at this stage of the operations. Great care, almost to laboratory accuracy, had to be exercised, since it was easy to dilute the smoke by an abundance of excess air in an attempt to keep the chimney smoke within the apparent regulated density of the Clean Air Act.

It must be borne in mind that it was particularly necessary to mix the secondary air and the combustion gases as soon as, and as completely as, possible when there were cold surfaces in the proximity of the grate.

The next stage of the operation—after the banked fires had been prepared for service—was the process of accelerating firing conditions during the time the steam pressures were brought up to normal working pressures from predetermined lower levels. It could be visualized that by bringing the steam pressures up in this manner it gave some indirect impetus in meeting the starting of engines and at the same time allowed a certain amount of time to get the fires on their way. But another important factor is that this was the stage where the building up of good working fires could be achieved—during the time the steam pressures were rising for the critical moment when the steam engines were to be started.

The important point here was that the coal would be charged into the furnace chambers in a cold state at an ever-increasing rate. There was a certain amount of free moisture in the fuel, particularly in the washed slacks which were often used. The free moisture content might be 12 per cent. more or less according to the weather, the process of washing and the size of the fuel.

The flames impinged on the cold fuel and moisture charges, and the combustion was to some degree arrested by the moisture, resulting in unburnt carbon escaping beyond the combustion chambers into the flue gases, again appearing as smoke.

Later in the process, when what might be termed comparatively heavy firing was continued on a rather thicker bed of incandescent fuel, the raw fuel, at the point of contact with the incandescent fuel, would produce CO_2 in a position in the fuel bed which was termed the oxidation zone. At a little distance from this zone, however, which might be termed the reduction zone, the CO_2 would mix with the liberated carbon and produce carbon monoxide, a combustible gas. This might pass through the top or distillation zone of the fuel bed and fail to burn fully along with other gases in the ignition zone such as hydrogen and sulphur vapour, owing to the temperature in the fuel bed and to an excess of CO. It might pass beyond the combustion chamber into the flues and to the chimney, where the soot and tar from cracked hydrocarbon in the flue gases was visible as smoke at the chimney top.

A further disadvantage during this process was the necessity for the slicing and raking of the fire to keep air circulating through the fire bed in order to break up coagulation of the fuel. This would restrict a good air circulation through the fuel, and so destroy the turbulence in the combustion chamber.

At this stage great care had to be exercised to regulate all air supplies, both primary and secondary, because of the ever-changing nature of the fuel bed, which was, first, increasing in thickness; second, increasing in temperature; third, possibly coagulating; partly as a result of the accelerating fire conditions and the interruption of turbulence in the combustion chamber.

During this stage of the building up of the fire there were heavy discharges of volatiles considering the temperature and mass of the incandescent fuel. There was also a potential danger of causing stratification over the fuel bed by supplying too much secondary air in an attempt to burn off the liberated volatiles. Excess air had a chilling effect, since normally air had to be at the flame temperature during the combustion process. All these conditions might contribute to making smoke.

The next two stages of operations were similar to one another—steam was being drawn off the boilers to start up the engines, first without load and later with the full load conditions.

In these stages of operation the forcing of the firing conditions is intense and stratification might again be experienced. This causes doubtful or delayed mixing of oxygen with carbon within the combustion chamber, but the results at this stage might be different from those previously, for it was more than likely that the fuel bed was hotter and so there was every possibility that a long flame would be produced instead of leaving unburnt volatile matter. This long flame might extend into the furnace chamber and impinge on the boiler metal and into the flues.

Assuming the temperature of this flame to be about 2,000°F. or less, depending on the distance it had travelled from the incandescent fuel, it would be chilled when it impinged on the boiler metal at a temperature no higher than that of saturated steam relevant to the pressure in the boiler (perhaps no more than 450°F. for low pressure boilers); combustion would thus be arrested and carbon therefore remain unburnt and appear as smoke at the chimney top.

It was well known that Lancashire boilers were more subject to these conditions during operation than other types of boiler and members of Mr. Redman's Association had about half the Lancashire boilers in the country.

It was well to remember that throughout all processes or stages of starting up from banked fires where carbon monoxide escaped beyond the combustion chamber, 4 to 5 per cent. of the heat produced by burning the fuel was lost for every 1 per cent. of CO so escaping.

The application of mechanical stokers had been found to help and good results had been achieved using almost all types of mechanical stokers during this period of start up, but there were a few points yet to be clarified in their use for this task.

Mechanical stokers certainly offered excellent advantages for normal running conditions and their use had proved that ideal running conditions could be attained. Furthermore, in nearly all cases, mechanical stokers stoke the boiler more economically.

Providing that the stoker manufacturers' technicians or too ambitious salesmen did not forget these hazards in starting up with banked fires, and made some allowances in their calculations for such conditions, it was possible that the problem of starting up from banked fires which Mr. Redman had outlined might to some degree be solved.

Kenneth Marshall said that in a body so knowledgeable on fuel, it was appropriate that he should start with that subject. The ironfoundries' main raw material in the way of fuel was coke. Coke, he understood, was a smokeless fuel, which meant that they were not offenders against the Act. In order to be effective metallurgically, that coke must contain little sulphur and little ash. Again, they were on the side of the angels and had nothing to defend. To some extent they were users of oil, electricity and gas, but not in respect of cupolas, which depended entirely on coke. The iron-founding industry, which produced between 3½ and 4 million tons of grey and malleable castings in a year, was mainly dependent on the cupola, which was not only a very efficient instrument thermally—he was told that its efficiency was as high as 90 per cent.—but also very efficient metallurgically, in that it took a mixture of pig iron, scrap and other ingredients and turned it into metal which, once cast, required no further treatment for use. In that respect cast iron was almost unique. It required no subsequent rolling or heat treatment and the mechanical properties which were produced by that single melting and cooling operation were the properties, in general, on which the engineer relied in his machinery.

Although structurally a cupola resembled a cocoa tin, it was not only an efficient but a very necessary piece of equipment from the economic point of view. There were about 3,250 of them in the country—an estimate with a wide range of error—and in any one week it might be expected that 2,000 would be in operation, although not in operation every day of the week or every part of the day. These were probably scattered among 1,700 iron foundries, a few of them large but the vast majority quite small. These cupolas varied in their melting capacity of metal from 1½ to 30 tons per hour. The melting ratio was about 8 of metal to 1 of coke.

From the point of view of the Clean Air Act, there was no dark smoke problem, certainly not in respect of the fuel. There was a marginal problem in that some iron foundries utilized and recovered a certain amount of contaminated scrap, which had paint, oil, or enamel on it, and the only effective means of removing that was to burn it off in the cupola. The proceeds of that operation were not very pleasant, but the alternative would be to leave that scrap lying where it was or drop it into the sea. They were therefore carrying out a necessary recovery operation. This was all the more important in the production of what was called refined iron, which was a form of iron cast into pigs and subsequently re-melted in an iron-foundry cupola. That process enabled a high grade iron to be obtained from relatively less expensive material.

If they were not offenders against dark smoke, why were they under the operative clauses of the Clean Air Act? He did not think the Beaver Committee ever intended them to be under those clauses; when the Committee referred to metallurgical processes, he was convinced that the industry would qualify under that heading. In that respect they would then have been under the Alkali Inspectorate, with expert knowledge of their particular problems. Indeed, they presented a case for this treatment, but on the whole that case had not been accepted.

The Junior Minister at the time, J. Enoch Powell, had made the following comments: " Plans and specifications for the dust and grit arresting plant to be used in connection with new furnaces are to be submitted to the local authority. The question they have to decide is whether or not to approve those plans and specifications. The Honourable Member for Stoke-on-Trent said he hoped the Minister would take a lead in setting up standards for dust and grit arresting equipment to see they were continuously improved. This subsection in Section 6 enables that to be done because it enables a standard of dust and grit arresting plant to be prescribed. It is clearly undesirable in respect of the same type of furnace that different local authorities should permit dust and grit arresting equipment of varying standards. We want uniform standards in regard to new methods of arresting dust and grit. That is the major purpose with which my Right Honourable Friend will operate this subsection." Mr. Powell then said that the Clause allowed reference to the Minister in awkward cases and that the Minister would decide what the standard should be where local authorities were not acting consistently.

The main difficulty with cupolas was to know what the standards were and how far they had to go in eliminating the offensive dust and grit or in complying with the dust or smoke nuisance Clauses of the Act. There was no possibility of achieving 100 per cent. success. If they achieved a theoretical 100 per cent. in the matter of clean air, it was clear that they would achieve 100 per cent. failure in the production of iron castings; there was no doubt about that.

They must know what the target was. In order to achieve a standard which conformed to the definition of " reasonably practicable " he submitted that they must consider the financial implications. There were two broad types of arrester, i.e. " wet " or " dry " arresters, which were clearly recognized as reasonably practicable within their own sphere. But when they considered the very small foundry, of which there might be 200 or 300 in the country, each producing less than 250 tons of castings a year, it was clearly only practicable for such foundries to have dry arresters which would retain very little of the finer dust, which would be visible in the atmosphere.

The question was, what would be reasonably practicable in this situation. If they were to apply a wet arrester to some of the small foundries, it was estimated that the cost of castings would be raised by £2 or £3 a ton, for which the consumer would eventually have to pay.

For the slightly larger foundries, producing more than 250 tons a year, he was prepared to accept the wet arrester, the cost of which might be £2,000 to £3,000 to fit, the operating costs not being excessive. That was a practicable piece of equipment, but the standard of efficiency from the point of view of the Clean Air Act was nowhere near 100 per cent. To get even within striking distance of the ultimate target they would need to fit electrostatic precipitators at a cost of £20,000 or more each, with very high maintenance costs, or bag filters or Venturi's, and he considered that these were quite impracticable.

A special problem for which there was no solution at the moment was the elimination of fume from the hot blast cupola. This was a scheduled process, and even the electrostatic precipitator did not achieve 100 per cent. success or anything like it. Wet washing was completely ineffective. This problem at the moment was in the hands of the Alkali Inspectorate, and it was understood that they had no solution as yet. A solution was still to be found in the United States, too.

Representatives of his industry had discussed with local authorities the target at which they should aim, and although mixed views had been expressed, he was glad to say that a full account of the meeting had been accepted as an agreed record and was being circulated to all local authorities in the country through their respective organizations. That was a most encouraging step and from both sides—industry and the local authorities—it was a good augury for the future implementation of the Act.

Apart from the question of standards and of cost, the remaining difficulty which he wanted to stress was that of time. The equipment industry—he spoke with diffidence here, because they might not be in a position to reply—had a limited capacity for wet arresters at the moment, numbered in only hundreds of cupolas a year. That had to be viewed against a total number of 3,000. Thus, on the existing scale there was a ten-year programme ahead of them.

That was not the whole problem. There was also the time taken to erect the equipment. This had to be fitted in with production schedules, often meaning week-end work, because a man could not work on the top of a cupola while it was red hot. A good deal of structural alteration was involved, too, particularly in the

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older foundries, which could add heavily to the cost and also to the time taken. There had been discussions with the Ministry and with the equipment manufacturers, who were well alive to the problem and were pursuing that aspect of it with vigour.

There were other processes, apart from the cupola, in which the iron-founding industry was a potential offender against the dark smoke regulations. He had mentioned the intermittent offence from the melting of contaminated scrap, but more important was the problem of the malleable castings section of the industry, about half the units of which, or more, operated on bituminous coal, firing with a long flame and a long period of heating up. This was an interesting problem to fuel experts on which he could not trespass with any certainty, but his understanding was that that process could not be speeded up and that a reducing flame was essential. It had not been decided whether that period was regarded from the legal point of view as "lighting up" within the meaning of the Act. If it were, they were not offenders. If it were not, then they were offenders and they had at the most five years to find some other way of making malleable castings, whatever it might cost.

E. J. MacDonald said he would concentrate on the strongly caking or coking coals. It was true that there was an answer to all these fuel problems but that sometimes it was expensive. There was, however, no mechanical stoker on the market designed specifically to burn these strongly coking coals. It was not that it could not be done; it was a question of capital cost. There were many such plants on the drawing board, and they would burn these fuels, but their capital cost was too great.

It was generally accepted that difficult coals were those having strong caking properties, usually of N.C.B. rank Nos. 500, 400 and 300. Coals of this rank could often be found in Durham, Yorkshire, South Wales, one or two pits near Wigan, Kent and Somerset. Most of them used in the United Kingdom were unsuitable for the coking and gas-making industry because they were high in sulphur or ash content.

There were so many different types of mechanical stoker on the market that he would classify them into four groups—underfeed retort stokers, spreader or sprinkler stokers, coking stokers and chain-grate stokers. If we had to burn these fuels on these stokers, how could this best be done?

Dealing, first, with underfeed retort stokers, graded coals were usually required for these machines, and it was often stipulated that these graded coals should be free burning. It was true to say that when these fuels were supplied there was no great difficulty in burning, provided the clinkering properties were not excessive. Some breakage took place in the worms and the fuel would then be fed from the retort in the form of a smalls. If the retort had not been designed in such a way as to ensure the uniform distribution of fuel throughout its length, uneven burning and coke trees would form. This would necessitate breaking them down manually. It was only manual handling of the fuel bed which produced smoke, and if one could concentrate the burning, increase the combustion rate to a high value, the tendency to produce these coke trees would be alleviated. With nearly all these coals it was important to burn at high combustion rates and to prevent disturbance of the fire manually. One way was to blank off one side of the retort, and by concentrating on the other side to blast the air right through the fuel bed.

Moreover, if green coal were charged on to a dead fire, smoke would be produced. The bed should be brought into incandescence and the fuel charged on top of this. In some cases where there was a tendency to produce smoke no provision had been made for secondary air. It was possible to run a machine with a slight suction over the fire, and this would induce some air over the grate to consume the combustible material.

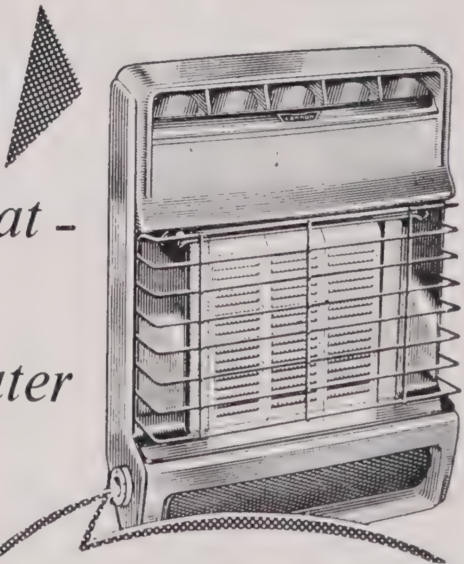
With sprinkler and spreader stokers the principle was the same; uniform fuel distribution was essential and it appeared that this could not be attained when using moving bars. Strongly caking coals, provided they were distributed evenly over the whole grate, could be burnt successfully because of the thin fuel bed and rapid rate of combustion. Usually, to attain a uniform fuel bed you needed graded fuel. Absence of self-cleaning grates necessitated hand cleaning, but if the fuel bed was burnt down before handling the fire, it would be possible to do this operation without creating smoke. It was, however, important to leave some live fire on the grate and bring it back again into incandescence before recharging.

With sprinkler and spreader stokers it

was necessary to use high combustion rates. The length or area of the grate must be made as small as possible in relation to the maximum load required. If working at half load, then cut down the grate area. He knew of cases where that had resulted in marked improvement.

Strongly caking smalls or graded coals should not be burnt in coking stokers unless a fast grate speed was available. As a rough guide, a bar speed of at least 4½ r.p.m. was required. Early coking stokers had a maximum speed of less than 3 r.p.m. and this was far too slow to burn caking coal. It was also important to make sure that air was passing through the grate and not through leakages round the side. It was essential to ensure that the combustion rate was maintained as high as possible, again relating it to the maximum load required. This called for the shortest grate which would be required for the maximum load required and not the boilermakers' rating. With stokers which were so designed, and providing the fuel was consistent, it was unnecessary to disturb the fuel bed, except approximately once per hour near the main ignition zone. If, for some reason, poking of the bed was required, it was best to use a poker like a ball pen with a small pencil point, inserting it along the whole length of the bar and not lifting it. If the poker were lifted and the fuel bed disturbed it would produce smoke, but if it were maintained on the bottom of the fuel bed there would be no smoke. Free moisture seemed to inhibit the caking tendency of any fuel, and was therefore most advantageous when burning these difficult fuels.

Turning to chain-grate stokers, when burning strongly caking coals it was imperative that the fuel be wetted to the optimum amount of moisture content, and it should also be consistent in quality. In a mixture of a coal of rank 300 with a coal of 500, the swelling numbers would be 7½ and 5 respectively. It was impossible to maintain a uniform fuel bed burning such mixtures; holes would form in the bed. Large lumps of coke would be formed. It was also known that cokes or devolatilized coal from caking coals produced unreactive cokes, which cannot be burnt efficiently no matter how the air was adjusted. This was an inherent problem. It was almost the same as



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handling slurry: keep it moving and do not let it stop, do not alter the rate of flow. The same comment applied to these coals: if they must be burnt, burn them at a constant rate and not on plants where there are fluctuating loads, because those were conditions which upset the fuel bed. Be consistent in size; it was often better to burn $\frac{1}{2}$-in. smalls than 1-in. smalls because the larger particles burnt at different rates from the smaller, producing uneven fuel beds.

(*Space unfortunately prevents the inclusion of the discussion that followed these addresses. It is hoped to report this discussion in our next issue.*)

AIR POLLUTION ABSTRACTS

327. Some Factors in the Design, Organization and Implementation of an Air Hygiene Survey. Phair, J. J. et al. (Int. J. Air Poll. **1,** 18–30, October 1958). In 1952, a project was initiated in Cincinnati which had as its primary objective the solution of problems encountered in the design, organization, and implementation of morbidity surveys attempting to relate human reactions to the low levels of atmospheric contamination commonly found in urban areas of the United States. A preliminary report has already appeared (Phair and Thomson, 1956). Three pilot surveys have now been completed. The time thus seems appropriate to review the experience gained from nearly 2,000 patient-visits, and to make certain recommendations with regard to both planning and operation of future, larger scale, air hygiene surveys.

328. A Study of the Average Distribution of Pollution Around Staythorpe. Meade, P. J., and Pasquill, F. (Int. J. Air Poll. **1,** 60-70, October 1958.) An examination has been made of the average distribution of sulphur pollution around Staythorpe power station in relation to sulphur output and wind statistics during the period November, 1951, to September, 1954.

Basic data, consisting of the seasonal averages of sulphur pollution as measured at fourteen observing sites at various distances and in different directions from the power station, were available as a result of a survey instigated by the Atmospheric Pollution Research Committee. If the measurements obtained at each observing site depend on the output of sulphur dioxide from the power station, then they should also reflect the wind distribution in the area. The importance of wind direction is self-evident, but wind speed must also be taken into account since, for a constant distance from an elevated source, concentrations are inversely proportional to wind speed. The fact that the individual observing sites were at varying distances from the power station was another factor that had to be considered. This is so because the ground level concentration downwind of an elevated source is small near the source, increases to a maximum some distance away and then falls off steadily as one moves still further from the source. This important factor was dealt with by studying the pattern of pollution in the area and then estimating along arcs of a circle of specified radius about the power station.

329. The Atmospheric Pollution of Cities. Lucas, D. H. (Int. J. Air Poll. **1,** 71-86, October 1958). The paper assesses the pollution levels of sulphur dioxide (and smoke) likely to be produced by the thousands of domestic fires in large cities. It shows that the major part of the pollution measured in large cities can be attributed to domestic fires even though the concentrations produced by a single fire are negligible.

An approximate formula is given so that city concentrations can be estimated if the rate of emission, the wind speed, and the size of the city are specified. The worst pollution occurs about a mile downwind of the centre of the city and pollution levels decrease extremely rapidly outside the city boundary, particularly when averaged over a range of wind directions. When the atmosphere is stable, ground-level concentrations tend to be high. The effect of fog is complex and uncertain. It appears likely, however, that SO^2 (and smoke) is removed by the fog and that the " time constant " is between 8 and 20 hours.

Princess Margaret in Huddersfield

It is reported in a local paper that while Princess Margaret was most appreciative of her reception when visiting Huddersfield recently, she had also noticed the dirty condition of many of the town's buildings. She had asked the Mayor what the town was doing about the Clean Air Act, and he had told her of the Corporation's plans. The Princess also noticed one mill chimney in the town which was emitting thick black smoke, and asked the Mayor whether legal action was going to be taken.

Cement Dust Inquiry Declined

The Building Research Station of the Department of Scientific and Industrial Research have declined to undertake an investigation into the effects of cement dust pollution on buildings and building materials in north Kent on the ground that the pollution is not serious. Swanscombe Urban District Council, who asked for the investigation, have been informed that the dust would have to be present in huge quantities to have a serious effect.

An association of the local authorities in the affected area, known as the Thames-side Joint Committee for the Abatement of Atmospheric Pollution, is continuing to press for a public inquiry, but so far the Ministry of Housing and Local Government have not agreed.

The Ministry's attitude is that they are kept fully aware of the problem and of what is being done to solve it by their Alkali Inspectorate, and that a public inquiry is not likely to produce any additional worthwhile information. The joint committee will be meeting next month to consider what further moves can be taken. Most of the cement works in the area are now equipped with electrostatic precipitators, which are said to arrest about 90 per cent. of the dust.

Liquid Fuels Conference.—A conference of the Institute of Fuel will be held at Torquay from May 11th to 14th, 1959. The object of this, the second conference on liquid fuels, is to bring up-to-date information presented to the Birmingham conference of 1948. A programme of 21 papers has been arranged. Details and enrolment forms are available from the Secretary of the Institute, 18 Devonshire St., London, W.1. All interested, whether members of the Institute or not, are welcome.

Occupational Health Conference—the 13th International Congress on Occupational Health is to be held in New York City from July 25th to 29th, 1960. Several thousand physicians, nurses, industrial hygienists and other delegates from more than forty countries are expected to attend. Information from the Secretary-General, Dr. Robert E. Eckhardt, Esso Research and Engineering Co., P.O. Box 51, Linden, New Jersey, U.S.A.

M.O.H. Attacks the Raw Coal Fire

Speaking to Stirling Rotary Club recently, Dr. E. Neil Reid, Medical Officer of Health for Stirlingshire, said that it might be hard to appreciate, but it was true, that the ordinary coal household fire was a greater contributor to deaths from bronchitis, heart failure and other chest diseases than the smoke from industrial chimney stacks. " This business of burning raw fuel in a hole in the wall," added Dr. Neil Reid, " is really a thing we must put to our wives as best done without."

Underground Gasification Experiments

N.C.B. to End Tests

Small quantities of gas produced at the National Coal Board's underground gasification site have been used to help generate electricity in the Central Electricity Generating Board's temporary pilot power station at Newman Spinney, near Chesterfield.

Within the next few weeks it is hoped that the full production of this pilot station will be achieved from gas provided by two different systems of experimental underground gasification.

One system was designed as a result of experiments carried out by the Ministry of Power and the National Coal Board. The other is based on Russian experience suitably adapted for conditions in this country and evolved as a result of exchanges of visits between experts from both countries.

The intention in the British experiments was to produce gas from seams which would not otherwise have been mined. Sufficient results have been obtained to lead the Board to the view that the commercial prospects of underground gasification, as far as the fuel needs of this country are concerned, do not justify further expenditure when it is clear that considerable development work remains to be done. The Board have therefore decided to terminate their development contract with Messrs. Humphreys and Glasgow and the production of gas and electricity on the site will cease in the early summer. Further trials will take place before then and will conclude the Board's present programme of experimental work on the underground gasification of coal.

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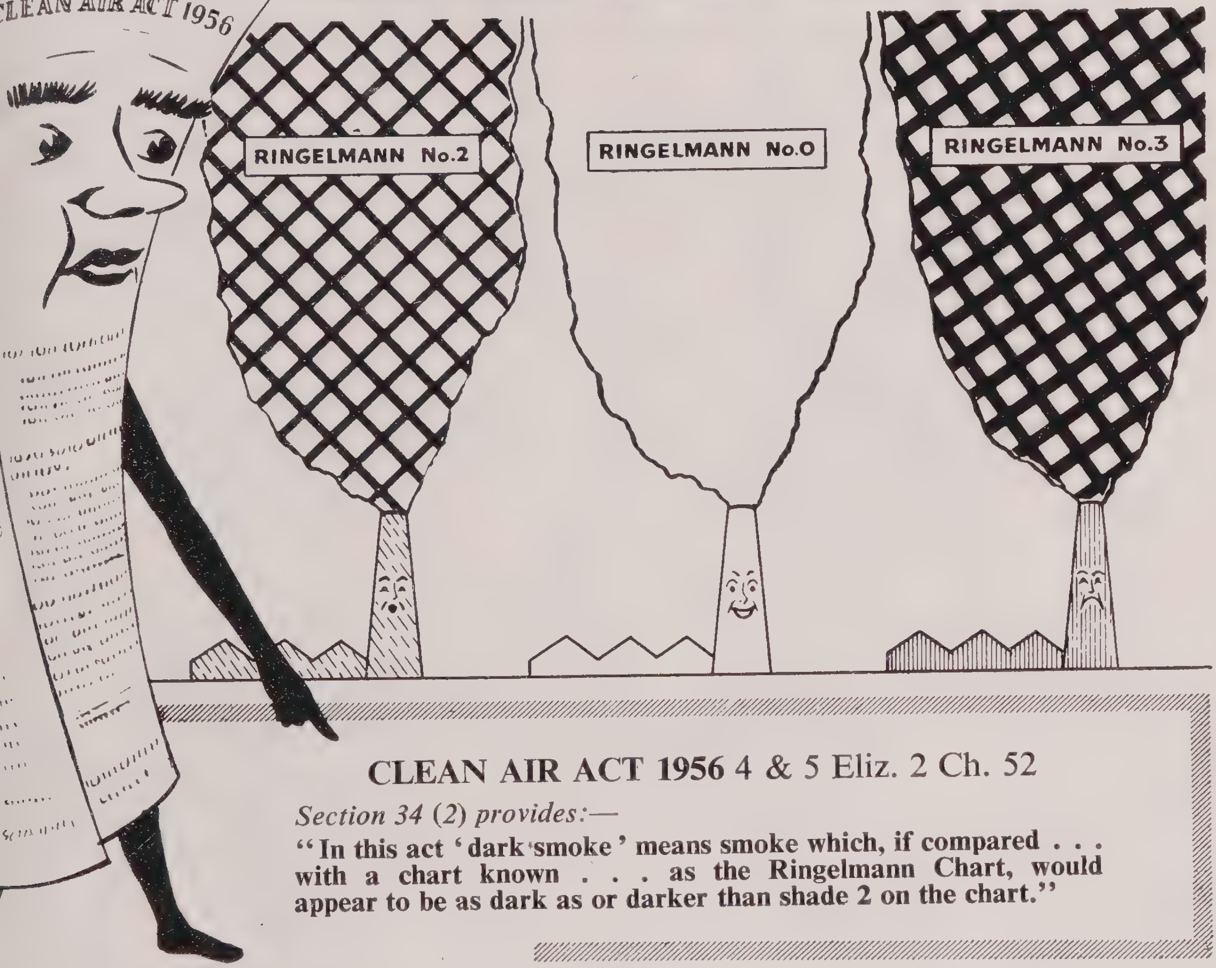

CLEAN AIR ACT 1956 4 & 5 Eliz. 2 Ch. 52

Section 34 (2) provides:—

"In this act 'dark smoke' means smoke which, if compared . . . with a chart known . . . as the Ringelmann Chart, would appear to be as dark as or darker than shade 2 on the chart."

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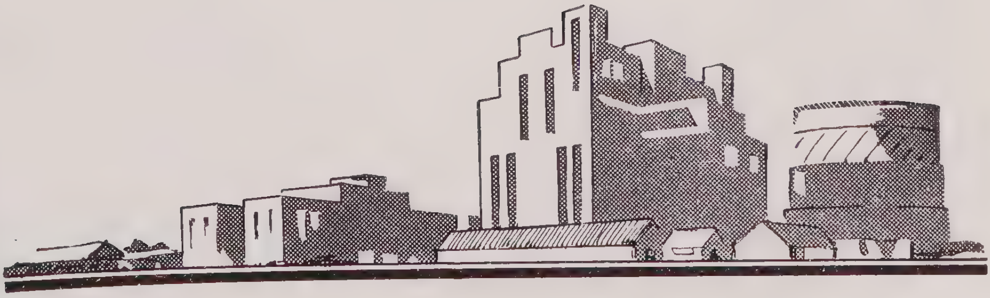

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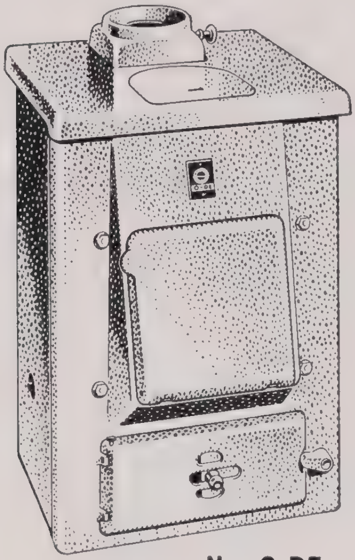

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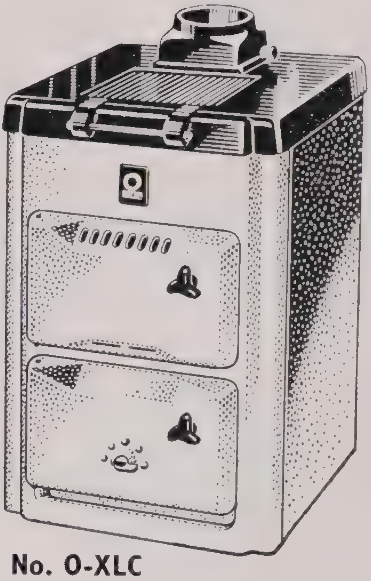

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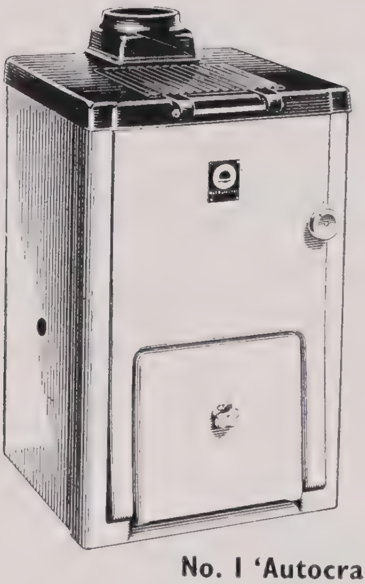

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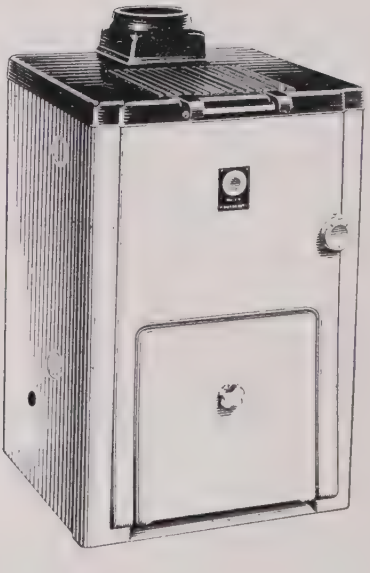

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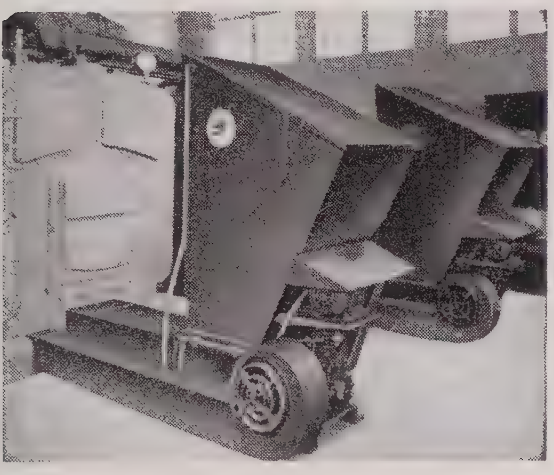

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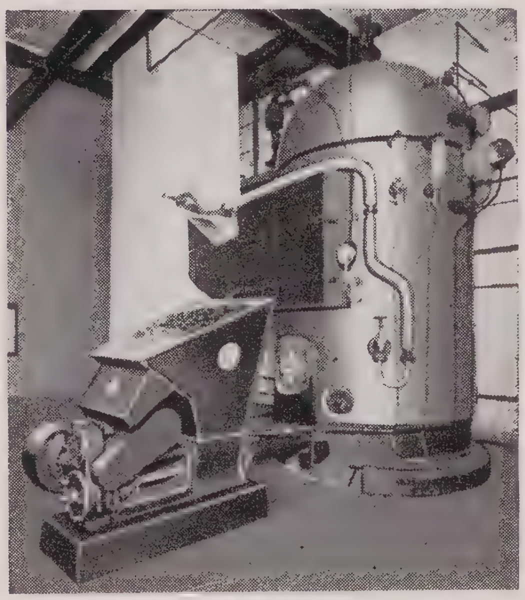

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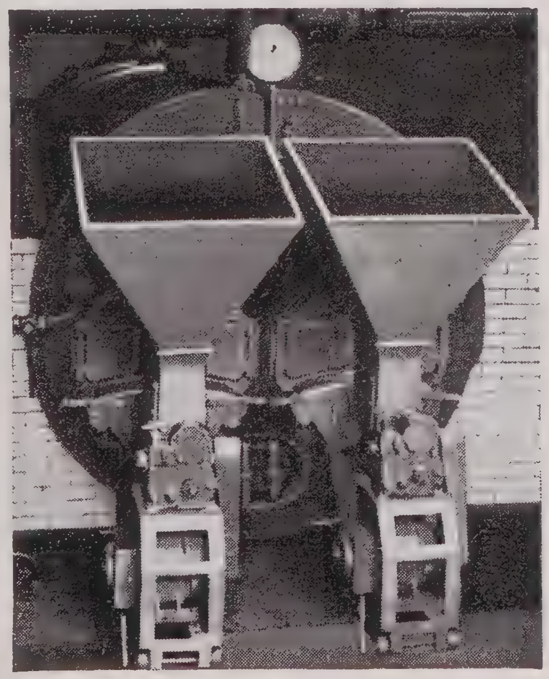

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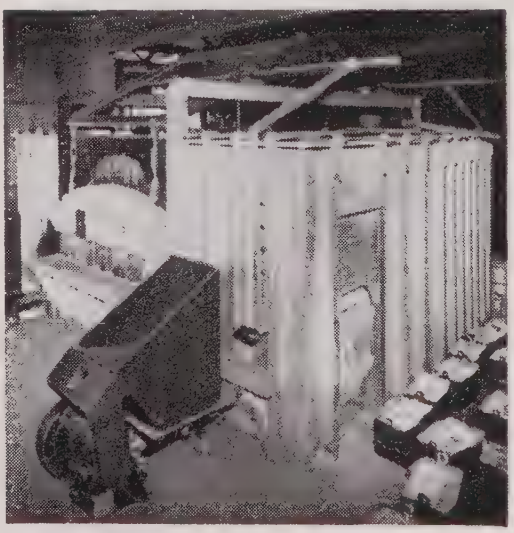

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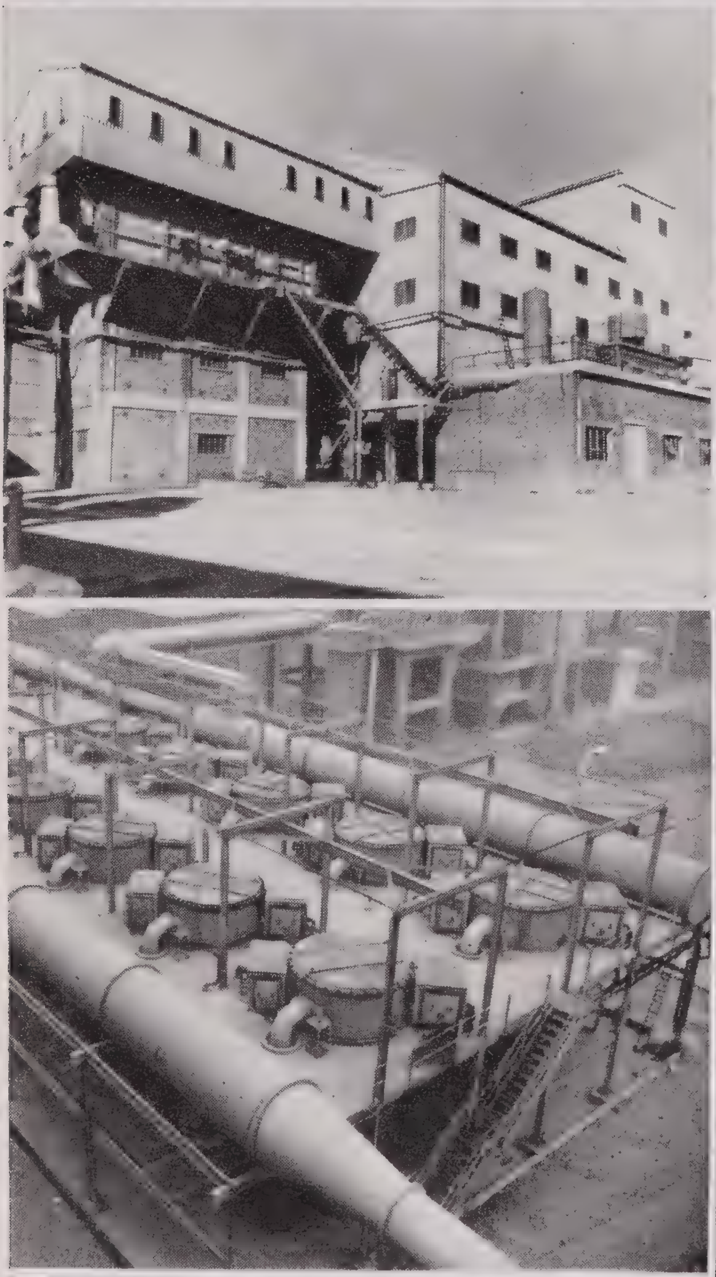

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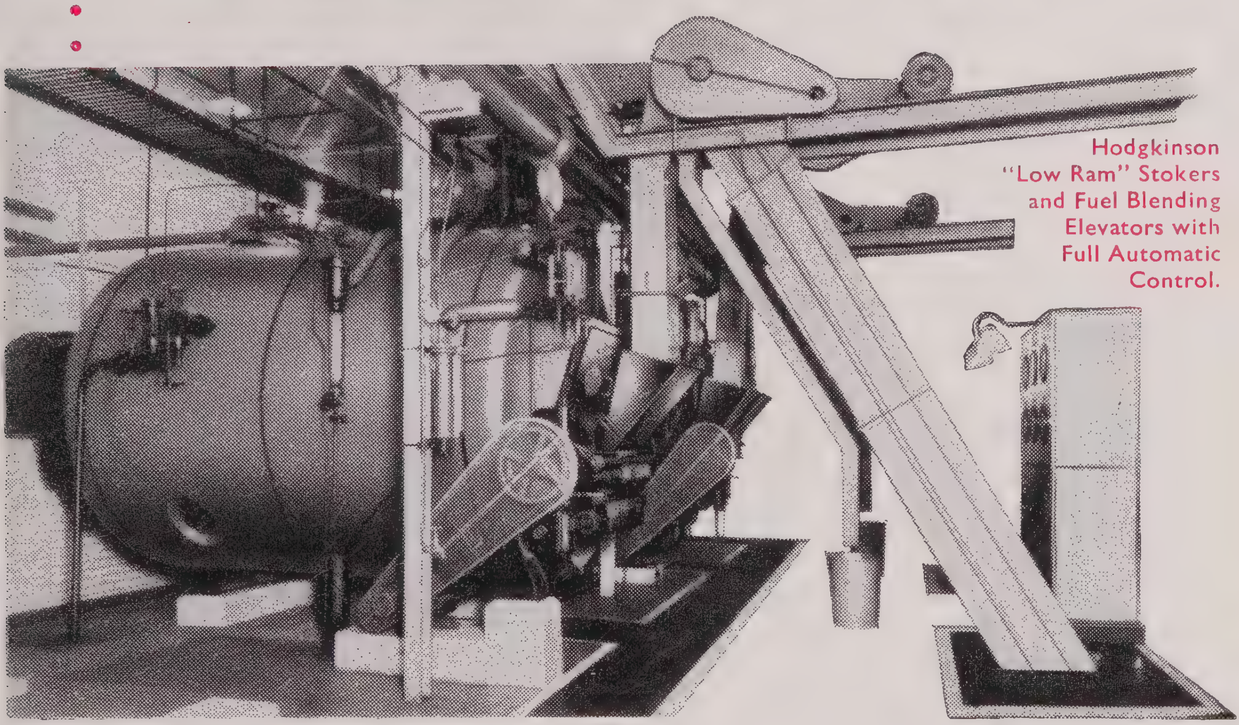

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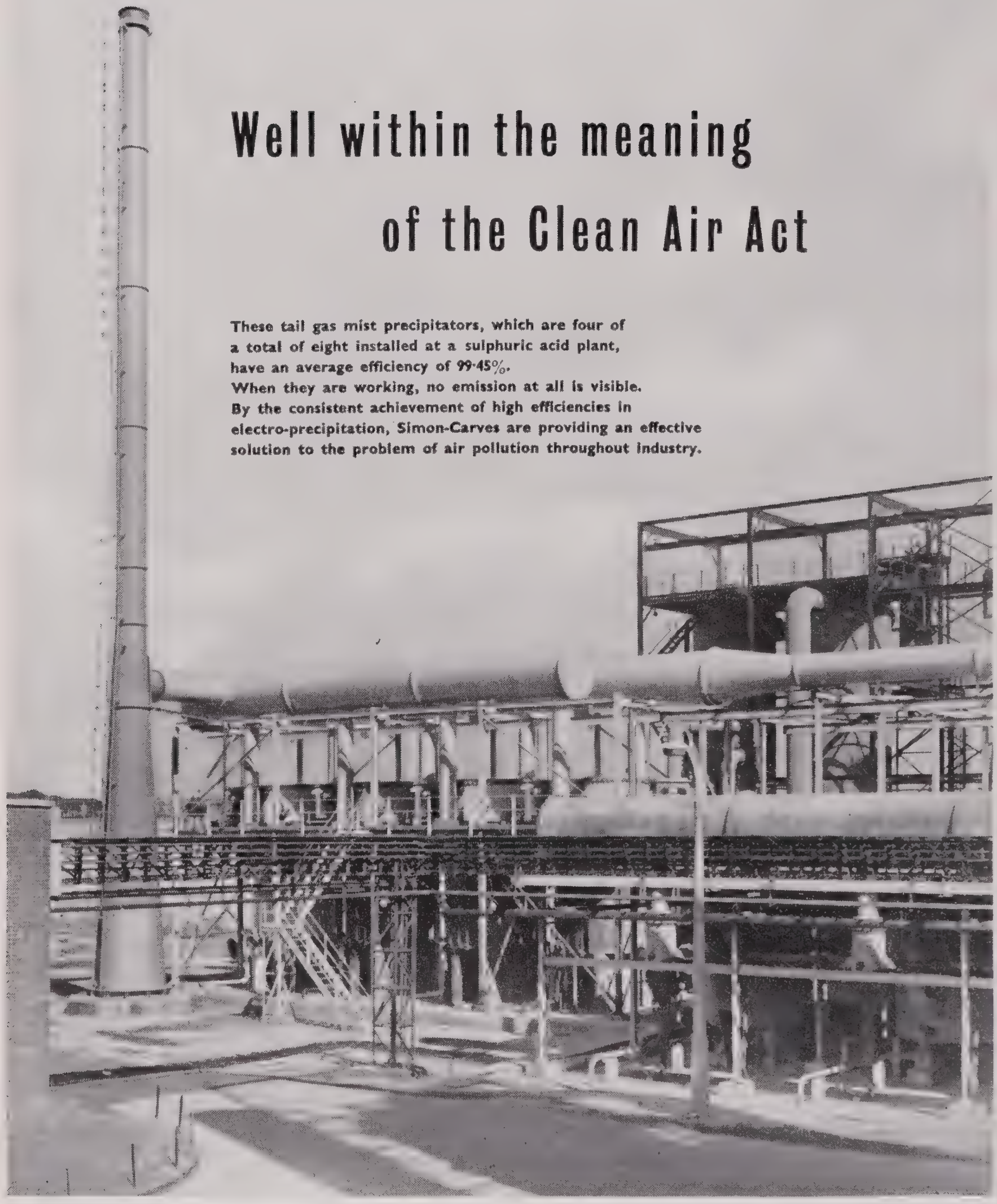
JOURNAL OF THE
NATIONAL SOCIETY FOR CLEAN AIR

No. 110 · SUMMER 1959 · 2/-

In this Issue

The Diamond Jubilee Conference ✶ The Coal Trade and Clean Air
Aeroions ✶ Facts about Air Pollution ✶ Meetings and Conferences
Uses of Small Coal in Industry, etc., etc.



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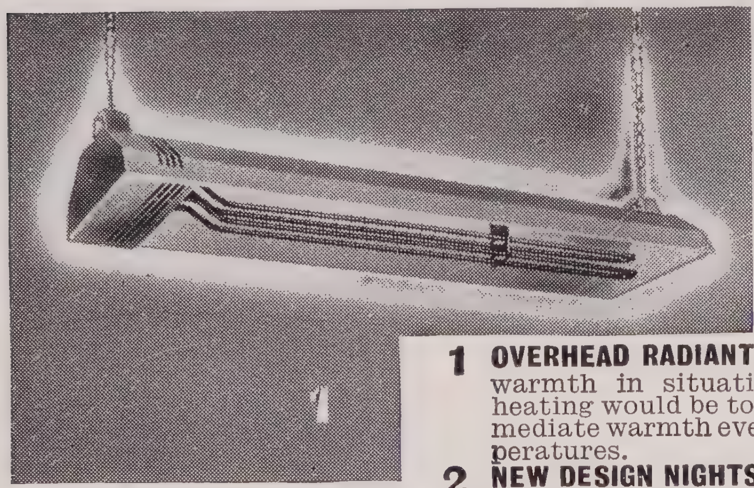

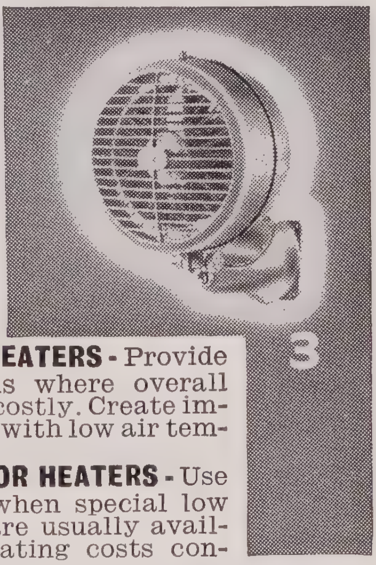

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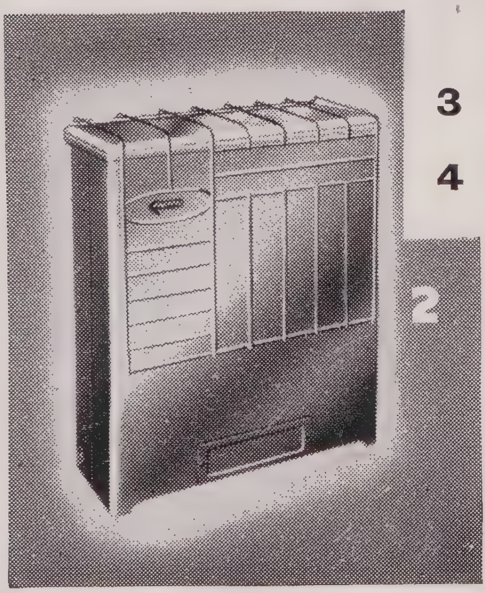

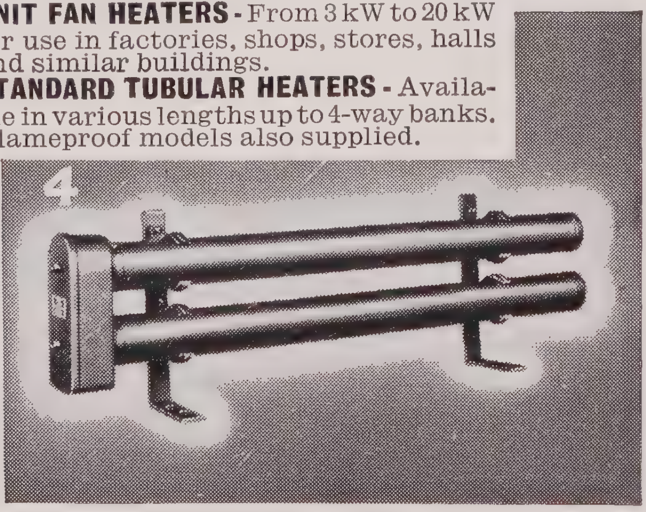

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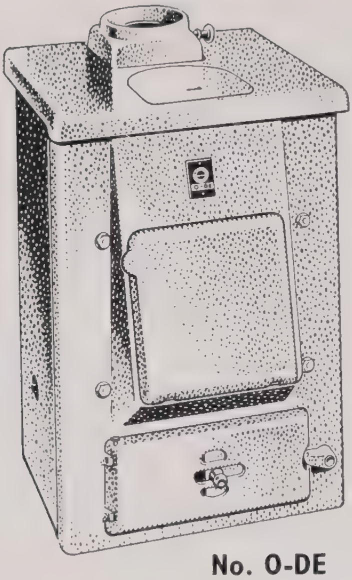

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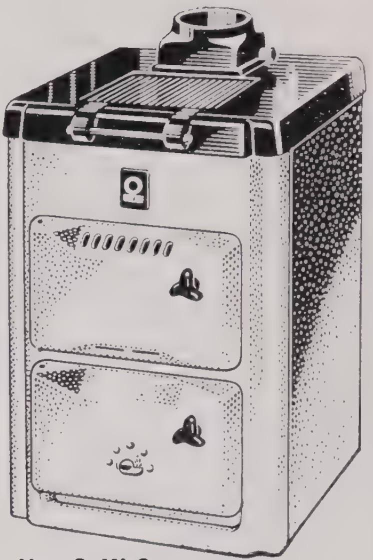

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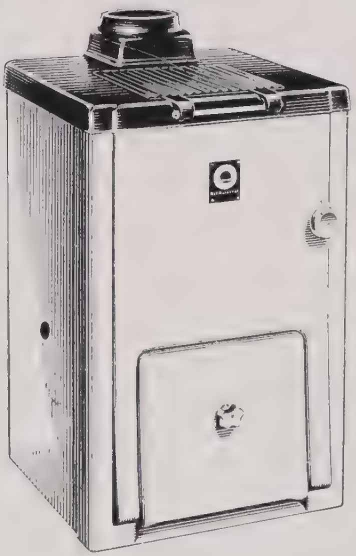

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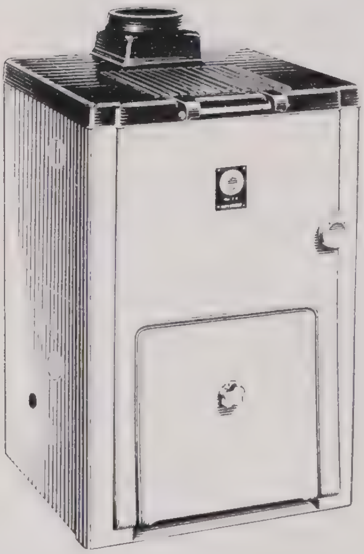

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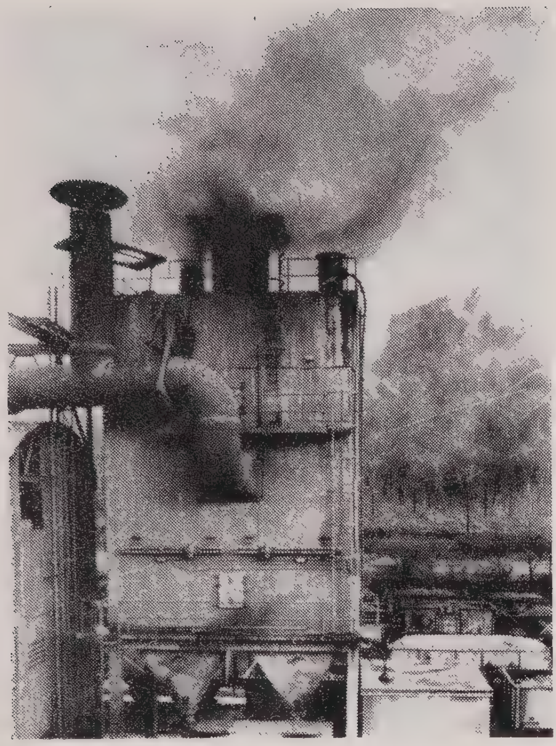

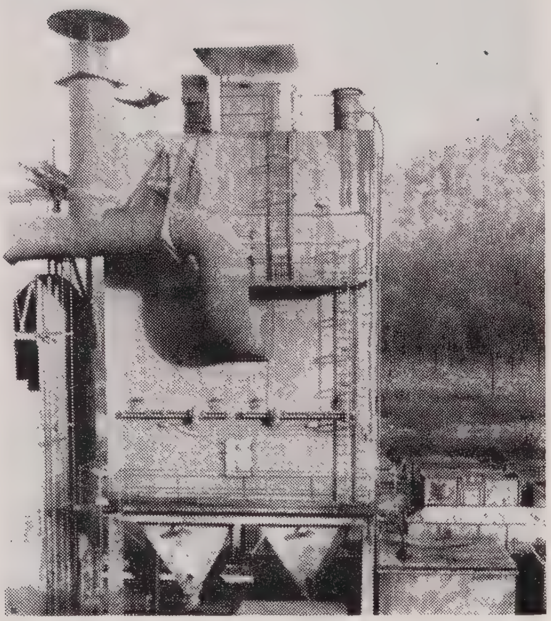

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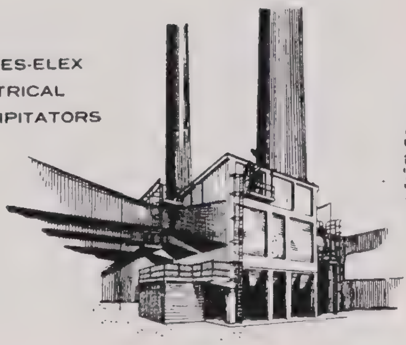

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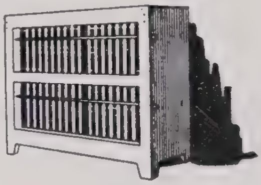

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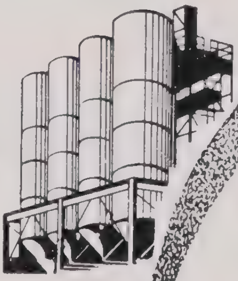

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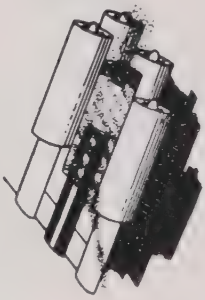

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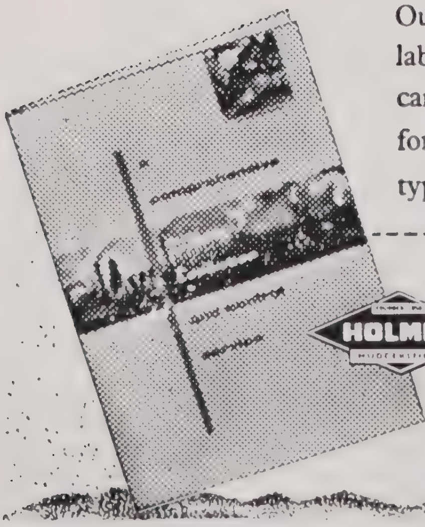

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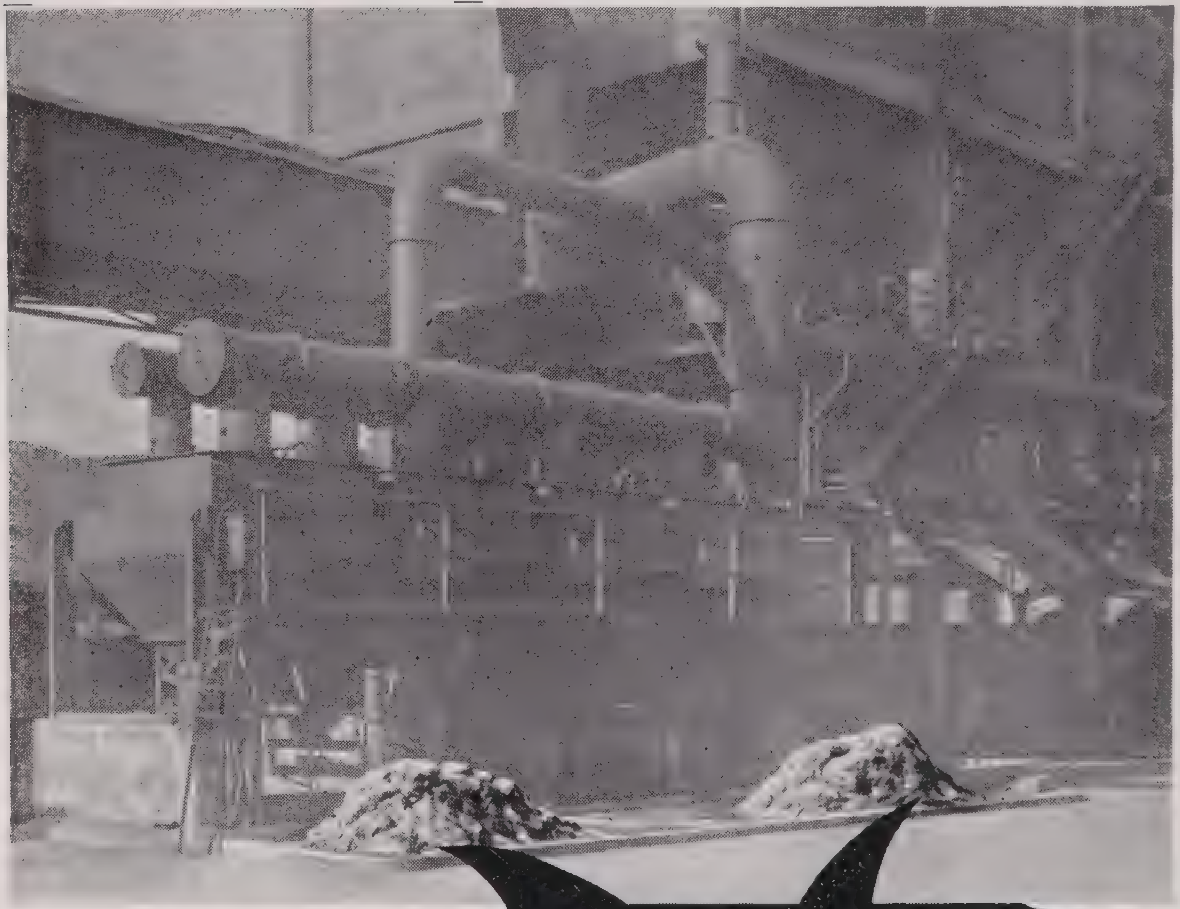

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MEMBERSHIP of the Society is invited and is open to individuals, local authorities, firms and other corporate bodies. Full details and membership application forms will be sent on request.

N.S.C.A. Diamond Jubilee

INTERNATIONAL CLEAN AIR CONFERENCE AND EXHIBITION

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(See also page 256)

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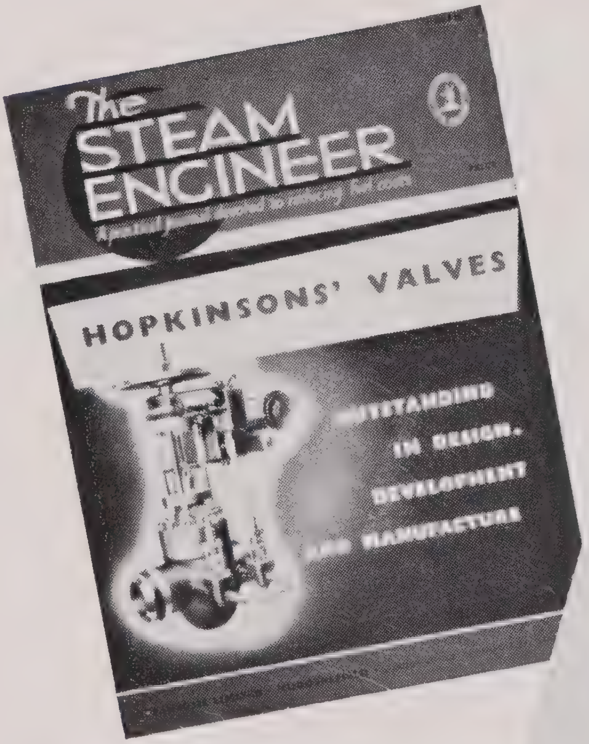

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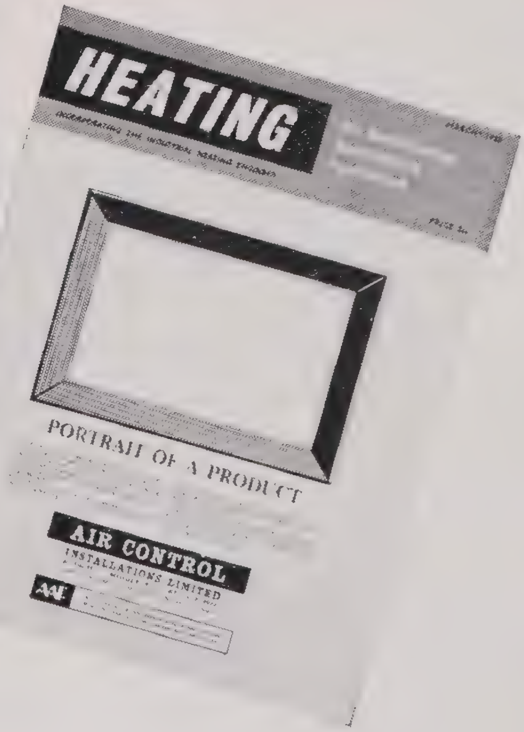

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SMOKELESS AIR

Vol. XXIX No. 110 Summer 1959

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Ships, towers, domes, theatres and temples lie
Open unto the fields, and to the sky;
All bright and glittering in the smokeless air.

SMOKELESS AIR

The Coal Fire Affair

THE resolution of the Executive Council, reported in our last issue, deploring the coal fire advertising campaign, drew from the Coal Utilization Council a reply that is reported on another page. Since this simply dodged the point of the Society's criticisms, a further short comment, also reported, was made and sent to the Ministers and the Clean Air Councils. We were pleased, though not at all surprised, to find widespread condemnation of this unfortunate attempt to retrieve the dwindling popularity of the raw coal fire. The report of a recent speech by Sir John Charrington, perhaps the most far-seeing personality in the coal trade, which is also quoted on another page, was of particular interest, for we have for long suspected that it would not be unfair to regard a substantial section of the trade as, in Sir John's word, reactionaries. We hope that they will take heed of his searching question:

> " Do you want to sell *coal*, or do you want to see as many homes as possible in Britain relying on solid fuel for their main space heating? "

This may be compared with the point made in the article on this matter in our last issue:

> " Although in the end solid fuel may cease to be used in the home, this may be a distant prospect. The surest way of bringing it nearer is to refuse to recognize the revolution [in heating standards] that is occurring and to base the values of solid fuel on flickering flames, cosiness and all that."

It is clearly difficult for the Government to interfere with anybody's advertising campaign, but careful reading of recent speeches by the Ministers of Power and of Housing and Local Government are quietly reassuring—to the clean air movement.

The Two-Headed Horse

Among the many comments on the C.U.C. position we like one that compares it with a motor car at a cross roads with both indicators out—hoping to go both ways. We are reminded of David Low's famous cartoon character, the carthorse with a head at each end, labelled " T.U.C." If Low would like to revive this, with one change in the letters, he would be performing one more public service.

Some of our members have expressed surprise that the C.U.C. should be a member of the National Society for Clean Air. They have of course been members for quite a number of years, thereby subscribing their adherence to the Society's objects. *After* a smoke control area has been approved they usefully help in publicity and information, and participate in clean air exhibitions—while of course at the same time telling the same people that there is nothing so cosy as a nice coal fire! Dr. Jekyll C.U.C. has taken space in the Society's Diamond Jubilee Exhibition. It is rather confusing, even Gilbertian, but the Society is a tolerant organization and we live in the hope (perhaps when the threatened schism in the coal trade has cleared the air) that the C.U.C. will decide to turn in the right direction and will cease from oscillating so distractingly and throwing away prestige so expensively.

Another aspect of the coal trade

propaganda, of which many readers will be (or ought to be) aware, are the district or regional committees of coal merchants, peculiarly known, apparently, as Clean Air Zones. These committees seem to be simply pressure groups, to operate when a smoke control area is being considered and before any decision is made. The questionnaires they have been sending out, as part of their campaign, to residents in the areas will be familiar to many.

Our Auditors

Ever since its days in Manchester as the Smoke Abatement League, the Society has enjoyed the assistance of the firm of Abbott and Son, of that city, as its Honorary Auditors. This started through the personal interest of the senior Mr. Abbott, and later that of his son, Mr. Norman Abbott, whose death was recorded with much regret a few years ago. The same service has been continued by the firm, for which the Council is most appreciative. In recent years, however, because of the growth of the Society and therefore of its accounts, it has become increasingly difficult—both to ourselves and the auditors—to have to dispatch a growing parcel of books and papers to Manchester, and to discuss any matters arising by letter. The absence of the books from the office for the audit has also been rather awkward. It has therefore been mutually agreed that the arrangement should be ended, with an expression of the warmest gratitude for all Abbott and Son have done over the years for the Society.

New auditors will require to be elected at the next Annual General Meeting, and until then the Executive Council has invited the London firm of Geo. Little, Sebire and Co., to act as Honorary Auditors, and will be pleased to nominate them for election in due course. The invitation has been accepted.

We are also very pleased to be able to announce that the firm of Bell, Brodrick and Gray have been good enough to accept an invitation from the Executive Council to act as the Society's Honorary Solicitors.

Year Book

Members will by now have received their copy of the 1959 edition of the Clean Air Year Book. We regret that it should have been so long delayed—the aim is to publish it in February or March—and it was this year more difficult than usual to make progress with its preparation. It is however hoped that it meets with approval and that the new items in the information section are found to be of value. The purposely grotesque photograph on the front cover has given rise to both frowns and congratulations—which shows that it has been noticed!

Fuel Abstracts

The Society joins with many others in regretting the passing of the valuable *Fuel Abstracts* that were formerly prepared and published by the Fuel Research Station of the D.S.I.R. The Station is of course now incorporated in the new Warren Spring Laboratory. The air pollution section of the monthly abstracts was particularly valuable for our own information and library service (and for this journal) and it was used also in the bulletin on the Investigation of Air Pollution. The Institute of Fuel has made a determined effort to produce the equivalent of the Abstracts, and there have been discussion with other bodies, including the N.S.C.A. For the present, however, the cost of the project, without Government assistance, is too heavy. It is a great pity that a publication so important for the advancement of fuel science and technology in this country should have had to be axed in this way, in the face of the fuel problems that face us now and will continue to face us. It is a decision that is very difficult to understand. We wish the N.S.C.A. could fill the gap in respect of air pollution alone, but our own resources do not make this possible.

There has also been some dismay over the ending, as a result of the same re-organization, of the Atmospheric Research Committee of the Fuel Research station—a committee which, over the years, has benefited from the membership of many distinguished authorities. It is true that there is a research committee of the Clean Air Council, to which expert advice can be given from the various Ministries, and it may be that it will be fully effective without the help of the outside scientists and specialists who have up to now contributed so much. Although we are not directly concerned, we would like to put on record a word of appreciation for their services to the study of air pollution.

Smokeless Fuels

We understand that the long-awaited British Standard specification for open fire coke is likely to be published in the fairly near future. This is welcome news, as is also the information that gas coke which meets the new standard will be sold under the brand name of " Gloco." This will be a vertical retort coke that meets the new standard quality requirements. It should be available throughout the country and is already being marketed by the North Thames Gas Board. A high-quality gas coke, with a name of its own to distinguish it from " coke " (with its uncertain and not always helpful connotations) was advocated in the journal years ago and we are indeed glad to know that this is at last coming about. Also of interest is the special new open-fire coke from the South-Eastern Gas Board, known as " Sebrite." A feature of this is that peat is used in its manufacture. Elsewhere in this issue we report the new department of the National Coal Board for the development and production of new smokeless fuels. Things are moving.

Sorry—Our Mistake

We apologize for an unfortunate error in our last issue, which we trust has not caused any difficulty to readers who may have accepted the statement made. In the article on page 184, " Does the Clean Air Act Discriminate against Coal? " it was said that the Smoke Control Areas (Exempted Fireplaces) Order, 1957, related only to oil-burning installations up to 55,000 B.Th.U.s. This is not the case. The Order relates to oil-burning installations of any size, although it should be noted—and it was this that led us astray in a hurried write-up—that the Order also affects the operating of Building Byelaws made under section 24 of the Act. It is now permissible, that is, under such byelaws, to install liquid fuel burning appliances, but such *byelaws* can relate only to appliances under 55,000 B.Th.U.s. Thus the Order applies to these small domestic-type appliances if it operates in the one direction (byelaw), but to appliances of any size if it operates in another direction (exemption in a smoke control area). It is an odd legislative arrangement but we hope that this note may have made it clear.

Smoke Control v. Slum Clearance

Wolverhampton Town Council announced on May 4th that they had decided to slow down slum clearance to allow a start to be made on smoke control. This decision is a direct result of the call for vigorous action against smoke pollution by the Ministry of Housing and Local Government. Although the Clean Air Act has been in force for two years now, very little progress has been made because all the public health inspectors have been fully occupied with slum clearance, which had a priority. The rate of clearing slum property is to be reduced from 500 to 300 dwellings each year, thus allowing some of the public health staff to be employed on the administrative work on smoke control.

The Diamond Jubilee Conference

Promising Progress

WHEN the Council agreed to embark on the organization of an International Clean Air Conference and Exhibition to mark the Society's sixtieth anniversary we had no idea whether it would or would not succeed as an event that could justify the word " international." The 1912 conference—which is described on another page—was no guide at all for 1959, and other more recent international meetings on air pollution were of a type different from that envisaged by the Council. Apart from its international aspects, the conference had to be of value and interest to our own members. Bearing in mind the limited number of countries concerned with clean air, and the general lack of organization and resources in many instances, we hoped that there would be, say, at least a score of delegates from overseas.

It was therefore encouraging to reach and pass this figure, and very gratifying now to be able to report an overseas representation figure of almost 90, with reason to believe that it may well exceed the hundred mark.

There are 22 countries so far represented, as follows:

Austria, Belgium, Canada, Czechoslovakia, Denmark, France, Germany (West), Ghana, Hong Kong, Italy, Japan, Luxembourg, Netherlands, Nigeria, Norway, Pakistan, South Africa, Southern Rhodesia, Spain, Sweden, Switzerland and the United States of America. In addition there will be representatives from the World Health Organization, the International Gas Union and the International Air Transport Association.

The attendance from this country will, we expect, be at least 800. Letters of invitation have been going abroad since before the end of last year, but only recently to our own members, local authorities, and other bodies.

The Sessions

The first conference session (Tuesday morning, October 20th) will be devoted to the official ceremonial opening, followed by the Presidential Address. It is hoped to be able to announce the name of the opener before very long.

The afternoon session on Tuesday, to be opened, we are pleased to be able to announce, by the Minister of Housing and Local Government, Mr. Henry Brooke, M.P., will discuss papers on national air pollution problems, legislation and administration in the different countries. The opening contribution, reviewing the situation in Great Britain—as the host country—will be by Mr. P. D. Coates the Assistant Secretary of the Ministry of Housing and Local Government concerned with air pollution.

Wednesday, October 21st, will be given over to a considerable number of contributions on technical and practical aspects of the problem. The Minister of Power, the Rt. Hon. Lord Mills, has kindly consented to open the double session, for which the opening or keynote contribution, surveying the world's energy production situation and trends and their effect on air pollution in the future, will be by Dr. G. H. Daniel, an Under-Secretary of the Ministry of Power.

Thursday morning will be concerned with Research, Investigations and International Co-operation, including some contributions on medical aspects of the problem. This session will be opened by the Minister of Health, Mr. Derek Walker-Smith. Mr. Gordon Nonhebel will act as *rapporteur* and open the discussion. On Thursday afternoon—the final meeting—there will first of all be papers and discussions on Public Opinion and Education, with an introductory paper by the Director of the

Society, and last of all a summing-up of the whole conference and final discussion.

Friday, the last day of the conference, will be devoted to visits to industrial, research and other establishments of air pollution interest, in which we hope many delegates will participate. Details will be announced later.

A Discussion Conference

In issuing its invitation to attend the conference the Council considered it necessary to extend an open invitation to submit short papers or written contributions. Again, the response has well exceeded expectations, and over fifty contributions had been promised by the beginning of May, most of them from overseas. As is customary in the Society's conference, they will be printed and distributed to delegates in advance. From the number (especially in the technical and research sessions) it will be seen that, to give maximum time to discussions and questions, the papers will not only have to be taken as read, but there will be very little time available even to introduce them. This we believe, is valuable. There is, after all, not a great deal of value in travelling long distances to hear spoken at length papers that can be more carefully read: the importance of this conference will lie in the discussion and the questioning that written papers should promote.

Other Arrangements

The Exhibition, which will also be held at the Seymour Hall, is well in hand. All the space was very quickly taken up, and we are sorry that a number of applicants have been unable to come in. (There will be much more space next year, at Harrogate).

The holding of a reception by the Rt. Hon. the Lord Mayor and Corporation of the City of London, at Guildhall, on the evening of Wednesday, October 21st, has already been announced. All delegates will receive an invitation. There will also be a small Government reception at Lancaster House on the following evening, Thursday, October 22nd, for overseas delegates.

Lady delegates are to be invited to late afternoon receptions or at homes at the headquarters and demonstration centres of the Womens' Advisory Council on Solid Fuel and the Electrical Association for Women—both addresses are within easy distance of the Seymour Hall.

The main conference publication will be a handbook entitled *Sixty Years for Clean Air*. This will contain material commemorating the Diamond Jubilee, the detailed conference programme, and the guide to the Exhibition. Because of its general "souvenir" interest a copy will be sent to all members and representatives of the Society, whether they are attending the conference or not. It will be the only conference publication for which advertisements are being invited.

FROM NEW JERSEY

Few people in this country will be familiar with the City of Perth Amboy, from which we have received a Progress Report on its air pollution work—one of the best produced and most persuasive modest booklets from a local government organization that we have seen. Perth Amboy is a town, hemmed in by others, on the seaboard of New Jersey. It is highly industrialized and has a population of 50,000 in an area of less than five square miles. There are only seven cities in the U.S.A. with populations under 100,000 who have full-time air pollution control directors, and Perth Amboy is the only one along the Atlantic sea-coast.

The report gives a clear account of the work being done and stress is laid on the fact that the plan for clean air is based on discussion, co-operation and persuasion, with the law and its penalties to be used when other methods fail.

The First Clean Air International

A Look Back to 1912

IT has been interesting, as we prepare for the Diamond Jubilee Conference of the Society to glance through the catalogue of the first international conference and exhibition on air pollution, which was held in 1912, in London, by our parent body, the Coal Smoke Abatement Society. As far as the available records show the event was very successful, although anxiety and perhaps difficulties were caused by the coal strike with which it clashed.

The conference and the exhibition were held in the Agricultural Hall, near the Angel, in March and April. The conference was for three days, but the exhibition (organized by Frederic W. Bridges) ran for thirteen days. Unlike the coming event next October, the exhibition appears to have been the main feature, with the conference tacked on to it.

The Society's President was then Sir William Richmond, R.A., but the President of the Exhibition was H.R.H. the Duke of Argyll, supported by a most distinguished company of 35 vice-presidents—the majority of whom were peers—and a Council numbering no less than 250.

The working chairman was Dr. Des Voeux, and Lawrence Chubb (later Sir Lawrence) was Secretary. In the long list of names we can find only two who are still with us and on the active list—E. D. Simon (now Lord Simon of Wythenshawe and then Hon. Secretary of the Northern Smoke Abatement League of Great Britain, and Dr. R. Lessing, who was Hon. Secretary of the Conference Committee. Though responsible for organizing the conference, Dr. Lessing was absent when it took place—on his honeymoon! The conference sent him a telegram of thanks and good wishes. Many of the others named now have a place in the nation's history, or in the history of the campaign for clean air—such as Oliver Lodge, William Ramsay, Lord Avebury, Bernard Shaw, Leonard Hill, David Milne-Watson, J. S. Owens, and others. Curiously enough, the Council included a Sir Hugh Beevor!

There were over sixty exhibitors, showing industrial and domestic equipment, gas, electricity, and some smokeless fuels. Among them are some who are direct descendants of present members of the Society, but only one whose name remains exactly the same—James Hodgkinson (Salford) Ltd., whose advertisement on the back cover of this journal will be familiar to all readers. The Woodall-Duckham Vertical Retort and Oven Construction Co. Ltd., one of our present Sustaining Members, has now shortened its name, and it is not difficult to trace the descent of the British Coalite Co. Ltd. to another Sustaining Member. From their catalogue entry the following may be quoted:

> " Seeing that Coalite deposits no particle of soot, it has not yet made many friends amongst the chimney sweeping fraternity, but, on the other hand, domestic servants welcome it, owing to the absence of smoke emission or deposit of dirt in the room, whilst the uniform heat maintained in the kitchener is a source of much satisfaction to the cook."

The other smokeless fuels exhibiting are no more — Tarless Fuel and Coalexld. The domestic appliances that were shown are not linked with the solid smokeless fuels in any way, but are simply improved forms of open grates or cooking ranges claiming to reduce smoke through better combustion. Electricity and gas each had halls or groups of stands, and there were half-hour lectures every day on cooking by gas, while an electric kitchen cooked the luncheons and teas that were available to visitors. In an article on electricity the following comment on the coal fire, still struggling for survival, is not without its point:

> " This labour of fetching and carrying is a curious survival and in many countries it has already disappeared. In America our methods are regarded with surprise and amusement, for in that country the servant girl has long been freed from the coal scuttle."

The industrial exhibits mainly showed furnaces and stokers and a few special purpose appliances that have long disappeared. One curious exhibit, from Germany, was a " Smoke Dissipator," which apparently consisted of a perforated extension to the chimney top, and for which no more was claimed than that it would more easily dilute the smoke and grit and so render them less harmful.

The Coal Smoke Abatement Society, even then, was seeking to promote an understanding that smoke prevention and fuel economy went together, and in an introductory article to the catalogue Lawrence Chubb wrote:

> " In the realm of industry striking improvements have been wrought, and it is at last generally recognized that scientific principles can now be so applied to the production of power that, in most cases at all events, it is in a pecuniary sense advantageous to avoid the emission of unreasonable volumes of smoke."

The Conference

Thirty papers were read or presented during the three day conference, the first day being devoted to smoke pollution and its effects, the second day to smoke abatement—the work being done and " practical expedients " —and the third day to law and legislation, ending with Dr. Des Voeux on " A Plea for the appointment of a Royal Commission." There was a speaker from Hamburg, Germany, and three from the U.S.A., one on " Smoke Abatement in Pittsburgh," and one, by Professor Veditz of Pittsburgh University, on " A tentative outline for an investigation into the economic phases of the smoke problem." This presumably was the beginning of the important investigations carried out later by the Mellon Institute, Pittsburgh, which provided so much of the data that was to be so valuable both to the U.S.A. and this country in establishing the case for clean air during the years after the first world war.

The catalogue includes the programmes of music that were given each day by the String Band of the Seventh City of London Battalion of the London Regiment and the Scarlet and Gold Orchestra. A Russian Balalaika Orchestra played in the Electric Restaurant.

International Journal

The second issue of the *International Journal of Air Pollution* (Vol. 1, No. 3, Jan., 1959, Pergamon Press, London) has now been published. The first issue, containing numbers 1 and 2, was noticed in our last issue. Among the contents are an article by Dr. R. S. Scorer on the behaviour of chimney plumes and one by B. R. Morton on the ascent of turbulent forced plumes in a calm atmosphere. Mary O. Amdur, of the Harvard School of Public Health, contributed a paper on " The physiological response of guinea pigs to atmospheric pollution." Papers from Japan deal with the colorimetric determination of sulphur oxides in the atmosphere and on observed concentrations of SO_2 and their relation to meteorological elements.

" Anti-Smog " Gasoline . . .

A new formula gasoline which cuts the amount of smog-forming hydrocarbons emitted from motor exhausts is being marketed in America by the Tidewater Oil Company for the same price as other high grade gasoline.

SMOKE CONTROL AREAS

Progress Report

POSITION TO 30th APRIL, 1959—TOTALS

	England and Wales	Scotland
Smokeless Zones (Local Acts) in Operation Acres, 3,400 Premises, 41,060	44	1
Smoke Control Areas in Operation . . . . Acres, 3,743 Premises, 24,859	32	1
Smoke Control Area Orders—		
Confirmed	87	2
Submitted	14	1
Proposals Notified	173	4
Not Confirmed (Deduct)	1	
Grand Totals	349	9

The lists given below are supplementary to the information in the last issue of *Smokeless Air* (Spring, 1959), which gave the position up to January 31st, 1959. They now show the changes and additions to April 30th, 1959.

Some of the areas listed are new housing estates, or areas to be developed for housing. The total number of premises involved will therefore increase. An asterisk denotes that there have been objections and that a formal inquiry has been or will be held.

ENGLAND AND WALES

New Smoke Control Areas in Operation

Newcastle-on-Tyne No. 1.

New Orders Confirmed but not yet in Operation

Basildon No. 1, Battersea No. 1, Birmingham No. 3, Brierley Hill Nos. 1, 2, 3, 4, 5, 6 and 7, Bristol No. 1, Enfield No. 1, Hammersmith No. 1, Hampstead No. 2, High Wycombe Nos. 6, 7 and 8, Hornchurch No. 1, Kensington No. 1, Knottingley No. 1, Leeds No. 1, Lewisham No. 2, Liverpool Nos. 4 and 6, Paddington No. 1, Preston No. 1, Royton No. 1, St. Pancras No. 1, Wallesey No. 1, Warwick No. 1, Wellington (Salop) No. 1, West Bromwich Nos. 2, 3 and 4, Westminster No. 2, Willenhall Nos. 2, 3, 4, 5 and 6.

Orders Not Confirmed

Chesterfield No. 1.

New Orders Submitted for Confirmation but not yet Confirmed

Bradford No. 1, Brentwood No. 1, Brighouse No. 1, Crompton No. 1, Droylesden No. 1, Ealing No. 1, Leamington Spa No. 3, Middlesborough No. 1, Saddleworth No. 1, Southall No. 1, S.E. Derbyshire No. 2, Stoke Newington No. 3.

Proposals Notified to the Minister

Aireborough Nos. 3, 4 and 5, Barnsley No. 1, Bexley No. 1, Brentford and Chiswick No. 1, Brownhills No. 1, Bury No. 1, Denton No. 4, Dewsbury No. 3, Exeter No. 3, Fulham No. 3, Grantham Nos. 1 and 2, Hackney No. 2, Hayes and Harlington Nos. 13 and 14, Horsforth Nos. 1, 2, 3, 4, 5, 6 and 7, Hyde No. 1, Jarrow No. 1, Keighley No. 1, Leamington Spa No. 4, Leeds No. 3, Leicester Nos. 4 and 5, Lewisham Nos. 3, 4 and 5, Leyton No. 1, Liverpool No. 9, Old Felton Nos. 1 and 2, Reading No. 2, Rotherham Nos. 4, 5, 6 and 7, St. Marylebone No. 3, Scunthorpe No. 1, Shrewsbury No. 1, Staines No. 1, Stalybridge Nos. 1 and 2, Swinton and Pendelbury No. 1, Wallesey No. 3, Walthamstow No. 1, West Ham No. 1, West Hartlepool No. 1, Willesden No. 2, Wilmslow Nos. 1, 2 and 3, Winsford No. 1, Wood Green No. 2.

SCOTLAND

New Smoke Control Areas in Operation

Nil.

New Orders Confirmed but not yet in Operation

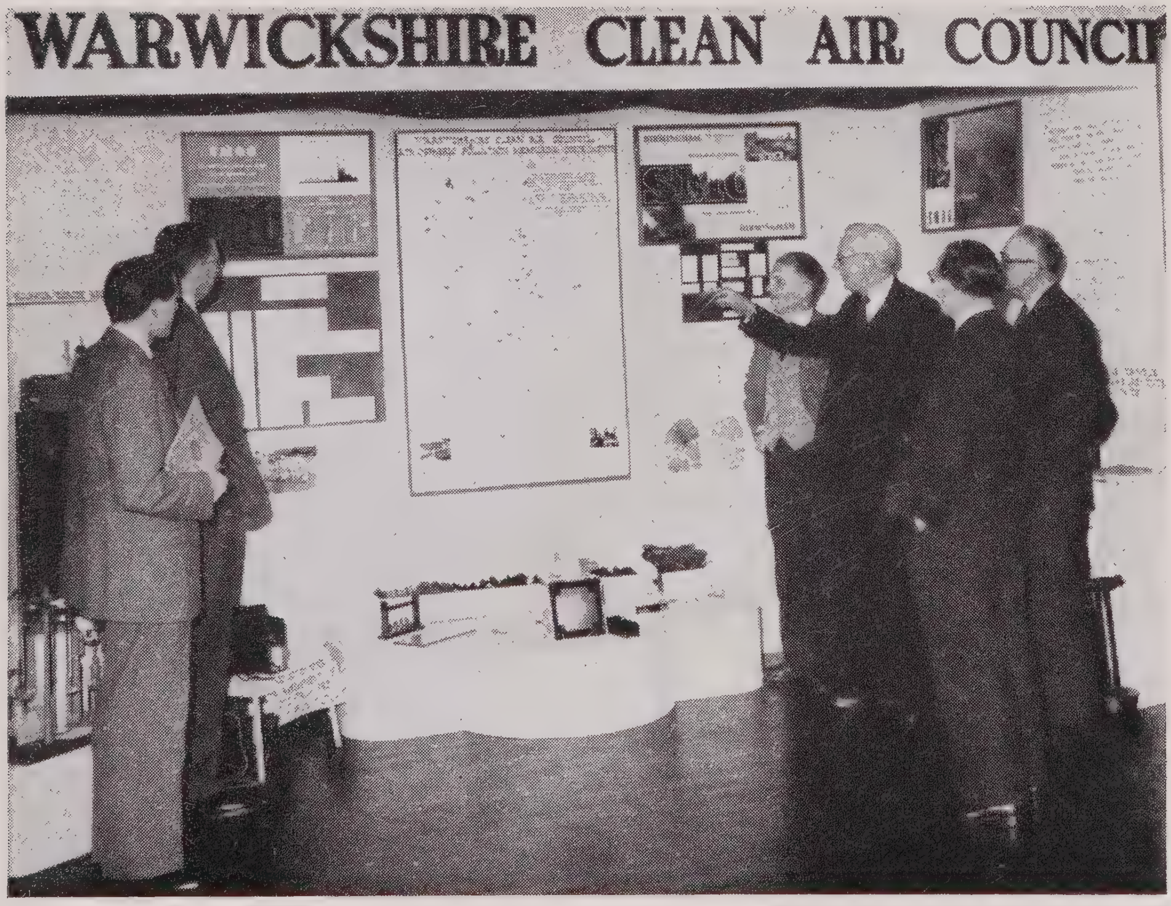
Glasgow No. 1.

New Orders Submitted for Confirmation but not yet Confirmed

Nil.

Proposals Notified to the Minister

Perth No. 1.



The Warwickshire Clean Air Council's Stand at the recent Leamington Exhibition, with G. W. Farquharson demonstrating

THE BLACK AREAS

The "black areas" referred to in the Beaver Committee Report, to be smoke controlled under the Committee's proposals, were not precisely defined. The Ministry of Housing and Local Government has prepared the following list of authorities which can be regarded as being in the black areas, but the list must be regarded as provisional only, and subject to local modification.

Tyneside and North Durham

Tynemouth C.B., Newburn U., Blaydon U., Felling U., South Shields C.B., Longbenton U., Wallsend B., Whickham U., Hebburn U., Boldon U., Gosforth U., Newcastle-on-Tyne C.B., Ryton U., Gateshead C.B., Jarrow B., Sunderland C.B.

Teeside

Hartlepool B., Darlington C.B., Stockton-on-Tees B., West Hartlepool C.B., Middlesbrough C.B., Eston U., Billingham U., Thornaby-on-Tees B.

West Riding N.

Keighley B. (Part), Aireborough U., Pudsey B., Denholme U., Sowerby Bridge U., Spenborough B., Morley B., Castleford B., Featherstone U., Wakefield C.B., Dewsbury C.B., Bingley U., Shipley U., Leeds C.B., Queensbury and Shelf U., Elland U., Heckmondwyke U., Rothwell U., Normanton U., Ossett B., Mirfield U., Baildon U., Horsforth U., Bradford C.B., Halifax C.B., Brighouse B., Batley B., Pontefract B., Stanley U., Horbury U., Huddersfield C.B.

West Riding S.

Sheffield C.B., Swinton U., Conisbrough U., Worsbrough U., Cudworth U., Darton U., Rotherham C.B., Rawmarsh U., Mexborough U., Dearne U., Wombwell U., Barnsley C.B., Royston U., Rotherham R.D. (Part), Doncaster C.B., Wath-on-Dearne U., Hoyland Nether U., Darfield U., Dodworth U.

North Midlands

Dronfield U., Bolsover U., Alfreton U., Eastwood U., Arnold U., West Bridgford U., Derby C.B., Kirkby-in-Ashfield U., Mansfield Woodhouse U., Hucknall U., Carlton U., Beeston and Stapleford U., Basford R. (Part), Ilkeston B., Staveley U., Chesterfield B., Chesterfield R. (Part), Sutton-in-Ashfield U., Heanor U., Nottingham C.B., Long Eaton U., Mansfield B.

Potteries

Stoke-on-Trent C.B., Kidsgrove U., Newcastle-under-Lyme B.

West Midlands

Aldridge U., Wolverhampton C.B., Sedgley U., Wednesbury B., Sutton Coldfield B., Oldbury B., Dudley C.B., Stourbridge B., Darlaston U., Nuneaton B., Brownhills U., Willenhall U., Coseley U., Tipton B., Birmingham C.B., Halesowen B., Brierley Hill, U., Solihull B., Bedworth U., Coventry C.B., Walsall C.B., Wednesfield U., Bilston B., West Bromwich C.B., Smethwick C.B., Rowley Regis B., Amblecote U.

London

Ruislip Northwood U., Enfield B., Tottenham B., Hornsey B., Walthamstow B., Ilford B., West Ham C.B., Twickenham B., Southall B., Wembley B., Richmond B., Wimbledon B., Sutton and Cheam B., Mitcham B., Bromley B., Bexley B., Dartford B., Harrow B., Wood Green B., Finchley B., Leyton B., Dagenham B., Heston and Isleworth B., Barking B., Ealing B., Willesden B., Kingston-on-Thames B., Surbiton B. (Part), Merton and Morden B., Beddington and Wallington B., Penge U., Erith B., Edmonton B., Hendon B., E. Barnet U., Southgate B., Friern Barnet U., Chingford U., Wanstead and Woodford B., Romford B., East Ham C.B., Hayes and Harlington U., Feltham U., Brentford and Chiswick B., Acton B., Barnes B., Malden and Coombe B., Epsom and Ewell B. (Part), Carshalton U., Croydon C.B., Beckenham B., Chislehurst and Sidcup U., Crayford U., City of London and all Metropolitan Boroughs.

South-East Lancashire and North North-East Cheshire

Heywood B., Crompton U., Oldham C.B., Middleton B., Little Lever U., Farnworth U., Aspull U., Hindley U., Tyldesley U., Eccles B., Golborne U., Salford C.B., Droylsden U., Ashton-under-Lyne B., Stalybridge B., Cheadle and Gatley U., Leigh B., Rochdale C.B., Royton C.B., Whitefield U., Kearsley U., Horwich U., Wigan C.B., Westhoughton U., Worsley U., Irlam U., Abram U., Manchester C.B., Audenshaw U., Mossley B., Hyde B., Bredbury and Romiley U., Altrincham B., Prestwich B., Bury C.B., Chadderton U., Lees U., Radcliffe U., Bolton C.B., Blackrod U., Ince-in-Makerfield U., Atherton U., Swinton and Pendlebury B., Urmston U., Stretford B., Failsworth U., Denton U., Dukinfield B., Stockport C.B., Sale B.

Merseyside and South-West Lancashire

Liverpool C.B., St. Helens C.B., Warrington C.B., Bebington B., Haydock U., Ellesmere Port B., Newton le Willows U., Litherland U., Huyton-with-Roby U., Widnes B., Wallasey C.B., Bootle C.B., Prescott U., Runcorn B., Birkenhead C.B., Ashton-in-Makerfield U., Kirkby.

Central and North-East Lancashire

Colne B. (Part), Brierfield U., Gt. Harwood U., Church U., Accrington B., Preston C.B., Bristol C.B., Kingston-upon-Hull C.B., Leicester C.B., Barrowford U., Burnley C.B., Rishton U., Oswaldtwistle U., Darwen B., Fulwood U., Nelson B., Padiham U., Clayton-le-Moors U., Blackburn C.B.

Wales

Llanelly B., Cardiff C.B., Merthyr C.B., Swansea C.B., Neath B., Port Talbot B., Rhondda B., Aberdare U., Caerphilly U., Gelligaer U., Glyncorrwg U., Llwchwr U., Maesteg U., Mountain Ash U., Ogmore and Garw U., Pontypridd U., Newport C.B., Abercarn U., Abertillery U., Bedwas and Machen U., Blaenavon U., Bedwellty U., Cwmbran U., Ebbw Vale U., Mynyddislwyn U., Nanyglo and Blaena U., Pontypool U., Rhymney U., Risca U., Tredegar U.

CLEAN AIR ACT CASES

Sec. 20. First Shipowner to be fined for Black Smoke in the City

In the first case to be brought under the Clean Air Act in the City of London, Prince Line Ltd. were fined £50 with £10 costs. The prosecution said their ship the m.v. *Egyptian Prince*, emitted black smoke for 10 minutes while berthed at New Fresh Wharf on December 10th. The emission came from a fault in the auxiliary boiler. The prosecution said that with nearly 30,000 vessels passing through the Port of London each year, the Corporation were very concerned about the smoke problem.

Sec. 20. Smoke Prosecution at Grays

William France, Fenwick & Co. Ltd. were fined £25 with £10 10s. costs at Grays on April 24th, for allowing their collier *Portwood* to emit black smoke for a total of 17 minutes in the Thames off Grays. The case was brought by the Corporation of the City of London who are responsible for health matters in the Port of London.

Sec. 1. Case Dismissed

The Rotherham West Riding Magistrates dismissed the first case brought under the Clean Air Act in the Rotherham area on Monday, February 23rd, when the N.C.B. were accused of emitting dark smoke from a chimney at the Silverwood Colliery for a total of 10 minutes during a 30 minute inspection on August 26th, 1958.

The Coal Trade and Clean Air

Clash over Policy may cause Split

SPEAKING to a recent meeting of Sussex coal merchants, Sir John Charrington said he found himself faced with a dilemma. Should he try to be encouraging, despite the facts, and say soft things; or face facts as he saw them, and endeavour to give a true picture? He hoped he would be forgiven for deciding on the latter, less popular, but more honest decision.

They all knew, said Sir John, that the demand for coal was falling each year. It was faced with the competition of trouble-free fuels—gas and electricity—so that if the decline was to be checked, coal must somehow be rehabilitated in public esteem.

" House coal," he said, " is not only falling in demand for the reasons I have given: it is also threatened by the Clean Air Act. Here we come, I fancy, to the big problem facing the trade, and which will cause a split in our Federation if the more reactionary elements get their way—as seems possible.

" I put this question to you—do you mostly want to sell *coal*, or do you want to see as many homes as possible in Britain relying upon solid fuel for their main space heating? This is a vital question and I would ask you to absorb what I have in mind. I could put it another way by saying—do you think it vital to advocate coal and only coal, or are you keen to sell any domestic fuel which you can handle? Coal or smokeless fuels?

" To my mind there should be only one answer to that question, but I regret to say that at Federation meetings I find the majority view to be: ' Coal is of all-in-all importance. If people cannot use coal they will turn from solid fuel. So let us nail our colours to coal and, if necessary, go down, but fighting for coal.'

" This, to my mind," continued Sir John, " is a policy of despair, and, moreover, it is a foolish policy, for it ignores the forces which are going to make the use of coal impossible in many parts.

" You may not—yet—have reason to worry about the Clean Air Act in Sussex, and, if so, I can see that you will perhaps prefer to advertise and advocate coal. Where I trade, mostly in London, the position is different, for smoke control may well come soon for ten miles round Charing Cross. I am afraid that most merchants there, in Glasgow, in Leeds, Birmingham, Manchester, Sheffield, etc., view the future with such alarm that they press for opposition to the Clean Air Act.

" Cannot these people see that their insistence on coal makes people think that if coal is barred then there is no point in sticking to the open fire? Do they not overlook the very widespread feeling among householders that there *is* something wrong in polluting the atmosphere—but who are ready to buy smokeless fuels?

" They ignore two facts. The whole of Parliament is behind the clean air movement and, what is more, the whole of the Press. Are these forces which can be flouted by the Coal Merchants' Federation? I am afraid too many merchants think they can."

The Alternative

Sir John continued: " What is the alternative which I commend? First, it does not denote any love for the Clean Air Act, but it faces up to facts and then tries to turn them to the best account.

" I recognize that the Clean Air Act has come; will stay, and will extend. I accept that as the will of the people. My concern, then, is to have plenty of solid smokeless fuel to sell, and which people will buy as and when clean air zones extend. This seems the only sensible policy; but there is a difficulty.

" The only large reserve of smokeless solid fuel is gas coke and the fact must be faced that gas coke is not yet a popular open fire fuel. But it can be made so, and on the lines which our coke association has already put to the Gas Council I am sure that coke will come to be accepted in future, as it is already in certain parts. The three essentials for a better market are: (1) carefully selected and consistent coke; (2) a new name and (3) sale for use in suitable grates.

"I do not deny that as areas become smoke-controlled there will be some loss of trade for solid fuel, but how much wiser to spread a feeling beforehand that there will be plenty of smokeless fuel to be had which people will like, than to despair and give an impression that if one is not allowed to burn coal, there is really nothing left for to use but gas and electricity.

"Do you want to sell coal? Or to maintain the greatest amount of space heating by solid fuel?"

THE C.U.C. MISSES THE POINT

Reply to the Society's Resolution—and a Rejoinder

The resolution of the Executive Council, published in our last issue, criticising the advertising campaign for the raw coal fire, received considerable attention and many expressions of appreciation. It drew from the Coal Utilization Council a detailed reply, the main points of which can be tabulated thus:

1. The C.U.C. does not accept the views of the Society's Executive Council.
2. The advertisements advocate the use of coal in new types of open fire, which can be used for smokeless fuels "should these be available in suitable quality and quantity, and should they either be desired by the householder or required by smoke control orders under the Clean Air Act.
3. Sixteen million tons of coal are used annually outside the black areas, and the C.U.C. "is therefore defending a legitimate market which will exist for many years to come."
4. It is not for the C.U.C. to comment on our views about the future of coal "except to say that the National Coal Board support fully our policy and publicity of the Council."
5. It is not the responsibility of the C.U.C. either to promote or to oppose the establishment of smoke control areas, although once any authority has decided to take steps to make a smoke control order it offers full co-operation on behalf of smokeless solid fuels.

This communication, which was also issued to the Press, was considered by the General Purposes Committee of the Society, which has issued and submitted to the Ministries concerned, and the Clean Air Councils, the following comment:

"The reply of the Coal Utilization Council to the Society's resolution criticising the extensive advertising campaign on behalf of the raw coal fire is largely devoted to explaining that the new appliances that are mentioned in the advertisements are also suitable for smokeless fuels. It is part of the Society's criticism that there is no reference to this important point in the advertisements themselves.

"The reply refers to the desire to retain a legitimate market in coal outside the black areas, but the majority of those who read the advertisements live in the black areas—that is, in areas that are to become smoke controlled. Since the principal theme of the publicity is that there is no fuel equal to raw coal, the implied corollary is that smokeless fuels are less satisfactory. If this suggestion was accepted by those living in prospective smoke control areas it would clearly be more difficult to secure the acceptance of smokeless fuels. This is the main reason for the Society's strong objection and it will be noted that it is completely ignored in the C.U.C. reply."

Comment on the Cosy Coal Fire

Wholly Reprehensible

The Coal Utilization Council's advertising campaign came under fire at a forum which followed the Warwickshire Clean Air Council's meeting at West Bromwich. Members of the panel were asked how extolling the virtues of the "cosiness of the coal fire" could be reconciled with a policy for clean air by the consumption of smokeless fuel.

The campaign was described as "wholly reprehensible" by one panel member, Councillor F. V. Magness, of Willenhall, who sits on the research committee of the official Clean Air Council. "Such advertising on television has perturbed me considerably, and I have written to the Minister about it. It should be stopped," he said.—*Birmingham Mail.*

A Bit of a Tangle

Since it decided to treble its advertising outlay and to concentrate on "plugging" the open fire, the Coal Utilization Council has got itself into a bit of a tangle. During the winter when the issue of clean air was bound to come to the forefront and one, which as it happens, has been the worst for smog for many a year, the open fire advertising campaign was pretty ill-conceived from the outset.

Now the Ministry of Housing has made the C.U.C. advertisements even more anomalous by issuing a propaganda leaflet in pursuance of the clean air campaign declaring that "Smoke is your enemy . . . if you burn coal in an open fire you cannot avoid making smoke." Moreover, the C.U.C. cannot avoid participating in exhibitions, such as that at Lambeth last week, designed to foster greater interest in smokelessness and admittedly it is ready to advise on installing smokeless appliances, if asked. . . .

Often before have sectional interests pulled against the public weal. People familiar with our fuel and pollution problems can think of many ways in which the C.U.C. could spend its money which would at once avoid this conflict and benefit its patrons. . . .—*The Statist.*

Tees-side Criticism

The C.U.C. publicity on television was criticised at a Tees-side Smoke Abatement Committee's meeting at West Hartlepool. Mr. J. Barrett, the Council's regional officer is a member of the anti-smoke committee.

The chairman, Councillor J. A. Brown, of Middlesborough, said to him: "You have on I.T.V. a film exhorting people to use coal in open grates. It is very difficult to be going all out for clean air when your organization is putting on this advertisement. Was it a mistake or is it your policy?"

Mr. Barrett said it would be considered a mistake in any area where the local authority was seriously considering introducing a smokeless zone. But it was not a mistake from the national point of view.—*Newcastle Journal.*

From Bolton

A television advertisement depicting the cheerfulness and desirability of an open coal fire was severely criticised by Alderman Childs, chairman of the Bolton Health Committee, at last night's Town Council meeting. He declared that smoke was one of the main reasons why so many people in this area suffered from chest troubles

Photo-Library *Oldham Chronicle Photo*

There's NOTHING like a Nice Coal Fire

and said that the sooner the whole of Bolton was smoke controlled, the better the Health Department would like it.

"When I see the advertisement on television and in the Press for open coal fires it makes my blood boil," said Alderman Childs, "because I know all the suffering there is in this town from chest complaints for which one of the main reasons is smoke."—*Bolton Evening News*.

Unkindest Cut

An important point to bear in mind is that for complete success all these (smokeless) fuels require acceptance and not merely lip service by the coal merchants. Recent correspondence in the *Manchester Guardian* and elsewhere (notably by Mr. F. C. Dobson, President of the Coal Merchants' Federation), coupled with the C.U.C.'s latest publicity campaign, must have cast serious doubts on that industry's willingness to play its proper part in the clean air movement. The fact of the matter is that the coal merchants constitute an industry whose backwardness is equalled only by that of the building industry and whose cussedness is equalled by none. In our view the vast majority of merchants have little sympathy with the difficulties of customers and are quite abysmally ignorant concerning the fuel they sell. For this reason Britain will attain clean air in spite of their efforts rather than because of them.—*Gas Journal*.

N.C.B.'s NEW PROCESS DEVELOPMENT DEPARTMENT

Dr. Bronowski's Appointment

The National Coal Board have appointed Dr. J. Bronowski as Director-General of a new department to take charge of the development of new processes for treating coal and in particular of the development of new processes for making smokeless briquettes from small coal. (The Department will be called the Process Development Department.)

Dr. Bronowski has until now been Director of the Board's Coal Research Establishment at Stoke Orchard, where several new processes for briquetting and treating coal have been devised in the laboratory. A special drive is now in progress to bring these processes to the stage of commercial production.

The production of coke, "Phurnacite," conventional briquettes and by-products will remain the responsibility of the Board's Carbonization Department under its Director-General, Dr. R. J. Morley. This Department will also remain responsible for the development of premium smokeless fuels in conventional coke-ovens, such as "Warmco."

The new Department will be primarily concerned, in the first place, with the development of the following processes:

- (*a*) making binderless briquettes by the "Shape" process;
- (*b*) the briquetting of char (made from small coal by fluidized carbonization) with a special binder;
- (*c*) treating conventional briquettes with mild heat so as to drive off the volatile matter which makes smoke.

The Department will come within the field of responsibility of Mr. A. H. A. Wynn, the Board Member for Science and Carbonization.

Dr. Bronowski has been Director of the Coal Board's Coal Research Establishment at Stoke Orchard since 1950. Members of the N.S.C.A. will remember his stimulating Des Voeux Memorial Lecture at the Society's annual conference in Blackpool in 1951.

N.C.B. Smokeless Fuel Production

Birch Coppice Colliery has been selected by the West Midlands Divisional Coal Board for experiments in the production of solid smokeless fuel. Speaking at a Press conference in Birmingham on 6th January, 1959, Mr. E. H. Browne (chairman of the Board) said that it was known how to make solid smokeless fuel from coal but the methods were problematical from the commercial point of view.

"We are going to install a small pilot plant at Birch Coppice Colliery to try out one of the methods," he added. "We know that the processes for making coal into smokeless fuels are rather costly jobs and because predictions on the commercial side are not really favourable we are being fairly cautious."

A.P.—London v. Durban

Durban had a greater degree of smoke concentration (0·222 milligrams per cubic metre) during winter 1956 than the City of London during January 1958 (0·205 milligrams per cubic metre). Two years later, as a result of the Durban Clean Air Campaign, the density had been reduced to 0·168 milligrams per cubic metre in Durban. These figures were given by Mr. K. R. Johnson, Durban's Air Pollution Control Engineer, who says that now during the winter months the general level of pollution in Durban is only slightly exceeded by the level in London.—*Durban Mercury.*

The West Riding Clear Air Campaign

Some Early Thoughts

By E. J. Winfield

Chairman of the West Riding Clean Air Advisory Council

WHEN in the latter part of 1957 the idea of a propaganda campaign was considered by the West Riding Clean Air Advisory Council, it was felt that the provisions of the Clean Air Act should be made more widely known to the general public and that by a prolonged period of publicity this could be achieved.

It was further felt that the best method of displaying to the public all that lies behind the Act would be by an exhibition and steps were therefore taken to explore (and, of course, eventually produce) a collection of materials and equipment from a number of sources, all of which could be travelled from point to point and assembled in more or less the same manner at each halt.

With the tour completed, one can reflect on personal impressions but a real assessment of the success can only be made after careful study of reports from the towns staging the exhibition.

Outstanding in my thoughts is the tremendous impetus given to the campaign by the support so graciously given by Her Royal Highness, The Princess Royal. In opening the exhibition at York and in attending the dinner at Leeds, Her Royal Highness not only conferred a great honour on the Advisory Council, but brought into real prominence the importance of clean air. When the campaign was mooted and even on its coming into being, no one dreamt of securing such high patronage and we shall ever remain grateful to Her Royal Highness for her kindness.

The exhibition has toured the West Riding, commencing at Wakefield and proceeding to Ossett, Dewsbury, Castleford, Shipley, Halifax, Batley, Barnsley, York, Bradford, Keighley, Huddersfield, Brighouse, Pontefract, Morley, Doncaster and Leeds. It has been staged in many buildings, some with ample accommodation—others with very limited floor space, but in all cases it has been made to fit and present an attractive display despite the difficulties.

One cannot but recall the opening at Wakefield where the City Council, persuaded by the Deputy Chairman of the Advisory Council, Mr. Boston, so bravely started the campaign in a large marquee in the market place, neither can one forget the torrential rain which marked the opening ceremony and threatened the whole proceedings.

In visiting the different towns I have been most impressed with the exhibits covering local matters as prepared by the various Health Departments. Not only have we had local statistics prominently displayed but practical examples of the damage caused by pollution. There has been a wonderful display of ingenuity and artistic production. The Huddersfield proceedings will long be recalled for the photographic slides produced to show the local problem, backed by a tape-recorded legend beautifully declaimed by a lady from the local repertory theatre and linked by a delightful musical sequence. At York opportunity was taken to display the

H.R.H. the Princess Royal, with Mr. and Mrs. Winfield, at the Dinner to celebrate the successful conclusion of the West Riding Campaign

dangers of bad lighting and heating equipment in the home giving rise to accidents, whilst a delightful touch of humour was added by a Victorian wash kitchen with its typical washing utensils and Victorian underwear.

In practically all the towns the exhibition was supported by public meetings, lectures, film shows and debates whilst additional interest was secured by poster and essay competitions for schoolchildren and questionnaire competitions for adults. The poster competitions generally produced some unusual ideas on atmospheric pollution and many of excellent artistic merit.

The six months have shown that such a campaign can only be carried through if one has first-class financial support and good technical organization augmented at local level by enthusiastic people who are prepared to give considerable time to local arrangements. The West Riding campaign has been most fortunate in this. Locally we have had liaison officers who were not only prepared to organize within their own district but to bring together groups of authorities and so give a wider aspect to the exhibition. Thus in a number of instances the static exhibition was supported by mobile exhibitions touring the surrounding areas. These liaison officers being responsible for all local arrangements have naturally relieved the Advisory Council of the burden of detailed preparation—a truly great asset.

From the exhibitors we have had tremendous support. First-class exhibits have been made available, have been moved from point to point, set up and manned by cheerful and willing staff, stripped and passed on to the next point.

The Advisory Council have been extremely fortunate in having the Solid Smokeless Fuels Federation to co-ordinate the exhibition and secure the continuity of the campaign. Its organized effort has enabled the campaign to flow with smooth efficiency and with only a few minor problems. One would be remiss if one omitted to mention the organizer, Mr. C. A. Byng Douglas whose personal guidance has had so much to do with the running. His calm efficiency, urbane cheeriness, inevitable cigarette (and smoke) have been constantly with us. Thank you C.A.B.D.!

As for public support: In almost every instance attendances have been reasonably good and undoubtedly considerable local interest has been aroused. Always have the local press given first-class publicity to the exhibition invariably stating a very strong case for clean air but one cannot but regret that during the period of the campaign when advertisements were stressing the importance of a cleaner atmosphere and the value of smokeless fuels, competitive advertisements appeared either before, after or even during the exhibition stressing that—"there is nothing so cosy as a coal fire." Such a situation has produced comment which has often been caustic and one cannot but agree that the situation has been somewhat Gilbertian.

Local authority members have given admirable support by their presence at opening ceremonies and meetings, by their utterances in favour of clean air and undoubtedly the presence of so many chains of office at the dinner in Leeds was an encouraging sign.

That the campaign should have followed a similar venture in the West Midlands and Lancashire particularly, does not leave any regret in the hearts of the Yorkshire sponsors, for this really has been a large scale sequel to a pilot scheme undertaken by them some three or four years ago which probably paved the way for all!

Aeroions

WE had not been aware, and were interested to learn from an article on the science page of the *Manchester Guardian* (21st April, 1959, by M. M. Barsh and P. L. B. Oxley) that people who live near fast mountain rivers and waterfalls live longer and rarely suffer from such ailments as high blood pressure, sclerosis, and asthma. This has been known for a long time, but only recently has the reason been found. It is because the air in such environments is richly charged with negative ions—that is, with molecules, or clusters of molecules, of oxygen charged with negative electricity. By sunlight, cosmic and terrestial radiations and other means, the neutral molecules of oxygen in the air are ionized and form positive and negative light ions. Fast rivers and waterfalls fill the air with minute droplets to which the light negative ions attach themselves to form heavier negative ions.

Negative ions have been found to be beneficial to health and the effects of "mountain air" are being used on an ever-increasing scale throughout the world, both clinically for curative treatment and as a prophylactic measure. Artificially generated aeroions are being used for treating bronchial asthma, disorders of the circulatory system and of the nervous system, of blood and blood generating organs. Negative aeroions retard the ageing of animal tissue, thus prolonging life. In the U.S.S.R. the negative ionization of closed atmospheres, as in coalmines, factories and hospitals, is being used as an air hygiene measure. The Meissner porcelain works in East Germany is reported to use aeroions to prevent silicosis. Artificial ionizers are being manufactured for such purposes.

It would appear, therefore, that negative aeroions are good for you, and the main purpose of this note is to look at the other side of the picture—the positive ions that are also found naturally and which may not only neutralize and lower the concentration of the beneficial negative ions, but which appear to have opposite effects—to cause discomfort, headaches, high blood pressure, and so on. Such concentrations of positive ions occur before storms (which are infrequent and temporary), in closed rooms occupied by many people (which can be remedied), and in town air contaminated by soot and dust. In dirty air the positive oxygen ions attach themselves to the particles and form heavy positive ions.

It has been determined that in some places there may be as many as 20,000 negative ions in one cubic centimetre of air. Certain spas have about 2,000, fields and moors up to 1,000—while city streets have only 100 to 200, and town houses as few as 40.

A contribution complementary to this article was presented at the National Conference on Air Pollution in Washington in November last, by John C. Beckett of the Wesix Electric Heater Co. This paper emphasizes the importance of the small negative ions and refers to recent work on physiological changes in the trachea (windpipe) caused by exposure to positive and small negative ions: " In normal air, because of the high mobility of small negative ions, a current of approximately 4 × 10^{-16} amperes per cm^2 is received on the membranes of the trachea. This ion current has been observed to stimulate the normal function of the windpipe in removing contaminants from air entering the respiratory system. Lack of these ions in contaminated air prevents increase in this physiological activity when it is needed most."

" On the other hand, a positive ion current of 12 × 10^{-14} amps. per cm^2 has a tendency to depress the normal windpipe mucus flow and cilia activity. Also, when the carbon dioxide content is higher than normal, a high density of small positive ions increases this effect. Fortunately, a high density of small positive ions does not usually occur with air pollution, although it may result as a by-product of air conditioning."

This is a most interesting and possibly very important new aspect of the study of atmospheric pollution in relation to health, which conceivably may shed new light on the effects, direct or indirect, of particulate matter. It suggests certain questions—what influence might air ionization have in relation to the chemical, etc., effects of pollution, and to what extent are negative ions diminished, or positive ions increased, in smoke haze and smog conditions?

Concessionary Coal

The West Riding Urban District Councils Association have passed a resolution asking the U.D.C.s Association and the Standing Committee of the National Conference of Local Authorities on Mining Subsidence " to express to the Minister of Housing and Local Government the view that a satisfactory settlement of the miners' concessionary coal problem is a pre-requisite to the submission of a phased programme under circular 5/59 for the establishment of smoke control areas in mining districts; that accordingly the Minister be requested to take action at national level to resolve the problem; that the date for submission of programmes in mining areas under circular 5 be cancelled and that a revised date be notified to the affected local authorities when the foregoing problem has been settled."

Hackney's Clean Air Centre

Situated near to the Town Hall, within the Authority's first Smoke Control Area, a pre-fabricated bungalow has been purchased by the Hackney Borough Council and converted into a permanent exhibition for the display of approved solid fuel, gas, and electrical appliances.

FACTS ABOUT AIR POLLUTION FROM HOMES AND FACTORIES

From a Paper by R. L. Brown, P. G. W. Hawksley and J. M. Horspool

A PAPER with this title was read at a meeting of the Institution of Public Health Engineers in London on May 14th last. The authors are members of the staff of the British Coal Utilization Research Association. The paper is not easy to condense, and is rather too long, with its figures and table, to record in full. However, a few sections are given below, together with the final "Conclusions." Also reprinted, for its special interest, is a table of new estimates of the weights of pollutants emitted annually, with notes, which it will be seen differs in one very important aspect from the estimates in the Report of the Beaver Committee. The B.C.U.R.A. estimate of the weight of industrial smoke reduces the figure from 800,000 tons per annum to 100,000 tons, but the estimated weight of domestic smoke remains at 900,000 tons.

After discussing the origin of the pollutants the paper continues:

Smoke Pollution from Homes

In discussing the origin of smoke it has been shown that bituminous coal cannot be burned smokelessly on the normal open grate and that this also applies to domestic stoves and boilers.

It has long been recognized that smoke from domestic sources is a serious problem and studies of this smoke release have been made in the laboratory by several workers. L. L. Fox gave figures for the weight of smoke produced from a given weight of fuel. His method of measurement using an optical meter calibrated gravimetrically gave lower results than the gravimetric method by the B.C.U.R.A. In this method the whole of the chimney gases are allowed to pass into a multiple tube electrostatic precipitator, with which the total weight of smoke may be directly and accurately determined. It has been established that from 2·5–5·5 per cent. of the coal is released as smoke. For typical chimney volume flows of 6,000–8,000 cu. ft./hr. at N.T.P. the smoke concentration is 0·05–0·15 grains/cu. ft. The amount of smoke is greater at low burning rates and with large refuel charges. Other work in the B.C.U.R.A. using a laboratory scale apparatus has shown that the volatile matter contents of a range of coals provided an approximate guide to the weight of smoke produced, but that a clearer relation was shown between smoke yield and hydrogen content (or Gray-King tar yield). It has also been demonstrated that the smoke produced from a char is appreciably less than that from a natural fuel of similar volatile matter content. Both these findings have recently been confirmed by workers at the N.C.B. Coal Research Establishment.

The earliest practical efforts to reduce or abate smoke production from homes date back nearly eighty years and a remarkable collection of smoke-eliminating fires and stoves was shown at the Smoke Abatement Exhibition of 1882. The appliances depended on either downdraught burning or the provision of heated secondary air to achieve smoke reduction. None of these appliances achieved any lasting success but the basic principles used have not been abandoned. One of the open fires developed during the early years of the B.C.U.R.A. employed preheated secondary air at high velocity, derived from an underfloor air supply. This system, amongst other things, reduced smoke formation by about half. Such appliances can still be obtained. More recently the downdraught principle has been resurrected in the form of an open domestic fire and a stove has now been marketed which is designed to burn bituminous coal by downdraught combustion. Even this type of combustion cannot be operated smokelessly at low burning rates or when lighting up. Work is in progress in the B.C.U.R.A. to develop an automatic unit which can burn bituminous coal slacks smokelessly. Heating plants for flats, schools, hospitals and public buildings are usually coke-fired sectional boilers. A small chain grate stoker for firing such boilers is being developed at the B.C.U.R.A.

At present the use of natural or manufactured smokeless fuel provides the only really satisfactory means of eliminating domestic smoke on the large scale. It is unlikely that incorporation of smoke reducing additives or catalysts could ever be technically or economically successful. The naturally occurring smokeless fuels of low volatile matter content are in short supply and, although gas coke is a readily available smokeless fuel, it has found limited favour with the public for open fire use because of its low reactivity. Numerous, mostly short-lived, processes for the manufacture of reactive smokeless fuels have been operated in the past, but until recently the only remaining survivors were the Coalite process and the Rexco process of the National Carbonizing Company. The general principle is to carbonize the coal at a temperature sufficient to produce a smokeless yet reactive product. The relation between residual volatile matter and carbonizing temperature for several coals is shown in a figure—it can be seen that at about 600°C. this residual volatile matter is almost independent of the original volatile content of the coal.

Some insight has recently been gained into the mechanism of the process of smoke reduction by partial carbonization. During a study of the action of coal chars on coal volatiles it was found that a mixture of carbonized char and raw coal in equal proportions formed into a briquette was substantially smokeless. The char material appeared to absorb the smoke-forming constituents from the coal and re-evolved them in a modified form at a higher temperature. Other recent work on the fundamentals of carbonization has involved a study of the Piersol method of rapid partial carbonization.

There are already a number of satisfactory processes in operation to manufacture various smokeless fuels. The two problems of keeping down the ash content to acceptable levels and manufacturing adequately reactive fuels are under constant review. The N.C.B. have developed the " Shape " process for briquetting small coals which are naturally smokeless, thus helping to increase the very limited supplies of these fuels suitable for the domestic grate. This process was designed to augment supplies of " Phurnacite " made by carbonizing naturally smokeless fuels with a binder. A process to manufacture a Phurnacite type of fuel from East Midlands high volatile coals has reached the stage of full-scale plant trials. The Gas Boards have been active in developing methods of producing reactive domestic cokes from weakly caking coals. Two of these fuels " Cleanglow " (N.T.G.B.) and " Phimax " (N.W.G.B.) are now being produced in useful quantities. The National Carbonizing and the Coalite companies are both endeavouring to produce the maximum possible quantity of their products (a new plant for the production of Rexco was opened in 1957).

Dust and Grit Pollution from Factories

It has already been suggested that industrial sources are not the most serious contributors to smoke pollution. Improved appliances and firing methods can reduce the periods during which dark smoke is produced to an insignificant level. Further, using the methods described here we have obtained in the B.C.U.R.A. evidence that, for industrial appliances, the weight of smoke emitted does not exceed about 0·2 per cent. of the fuel fired, even under " dark smoke " conditions. This is less than one-tenth of the average domestic smoke emission. On the other hand, industrial sources are the chief producers of grit and dust. In modern power stations 95 per cent. or more of the dust is collected in electrostatic precipitators or cyclones and the remainder emitted into the atmosphere from tall chimneys. Thus although the total weight so emitted from a station burning up to a million tons of coal a year may be considerable, under most atmospheric conditions the dust is likely to disperse at a comparatively high altitude and the ground level concentration is low.

Certain knowledge of the relative contributions of the various sources must depend on extensive measurements of dust emission in the field. As a necessary preliminary, much effort has been devoted recently by several organizations to developing dust sampling equipment. In the B.C.U.R.A. we have developed an improved sampling apparatus which is capable of giving rapid and reliable results under industrial conditions. The equipment has been made as simple and robust as possible and has been specially designed to differentiate between grit, dust and smoke particles. The apparatus consists of interchangeable components and may be used as an internal or an external probe. A sample of the flue gases is drawn from the sampling nozzle through a small cyclone designed to arrest all particles greater than one micron in size. These grit and dust particles collect in the cyclone hopper and the gases pass on through a filter which removes the smoke particles. Hence the weights of smoke and dust particles may be obtained separately. The grit content is determined by sieving the dust through a 72 mesh sieve. Isokinetic sampling conditions are maintained by adjusting the sampling rate so that the pressure drop across the equipment bears a constant relation to the pitot static pressure at the sampling point.

This equipment has been used for a number of tests on a wide variety of industrial combustion appliances. The results of the tests will be given, together with a full description of the sampling apparatus and the techniques used in a Handbook to be issued shortly by the Association. Perhaps the most significant result has been the discovery already mentioned, that the proportion of fuel emitted as smoke is less than 0·2 per cent. Usually the dust emission does not exceed about 0·4 per cent. of the fuel fired (of which about a quarter may be grit) but in extreme cases the emission may be much worse than this. It may amount to several per cent. of the fuel fired and severe local pollution may result.

There are two ways in which dust and grit emission may be minimized. Correct operation of the plant will help to reduce the emission. If the formation of " blowholes " in the bed is avoided, the plant is not overrun and the air rates are not excessive, dust emission is not serious. The best conditions are probably obtained by burning graded fuels at low rates. The worst conditions are found at high air rates, particularly when sprinkler stokers fitted with forced draught fans are used to fire a dusty fuel. In such cases a dust arrestor is the only solution.

The simplest type of dust arrestor will remove practically all of the larger grit particles but more elaborate equipment such as electrostatic precipitators are needed to remove the fine dust below 5 to 10 microns efficiently. This problem has been fully discussed by Stairmand and Jackson, who have described the various forms of grit and dust arrestor. Stairmand has given estimates of their performance and Jackson has given an account of the problems associated with their use.

The chief problems are maintenance of the equipment in an efficient condition, and the variation in efficiency with loading. The capital cost of electrostatic precipitators is very high;

they are designed to deal with the maximum load as their efficiency is greater at light loads. Mechanical arrestors have low capital cost but are less efficient at low loads—they work best at a fixed load, a condition seldom experienced in practice. What is needed for industrial equipment is an adjustable cyclone, automatically operated so that the pressure drop across the cyclone varies with the loading on the equipment.

Sulphur Pollution from Homes and Factories

Sulphur is probably a worse menace than smoke or dust, although it may be that its harmful effects are aggravated when it is present together with these other pollutants. Nearly all of the sulphur is released from fuel burned in industrial or domestic appliances. A small proportion is emitted directly as sulphur trioxide. In power stations this proportion lies between 1 and 5 per cent. of the total sulphur emitted and this figure is probably also correct for industrial appliances. This sulphur trioxide will form sulphuric acid mist immediately on contact with atmospheric moisture. More sulphuric acid is likely to originate from the sulphur dioxide which forms the major sulphurous constituent of the flue gases. There is evidence that a significant proportion of this gas oxidizes to sulphuric acid within a few hours of emission, before the natural dispersive processes can be fully effective. The role of sulphur oxides in atmospheric chemistry is under investigation in several countries, and attempts are being made to relate the concentration of sulphur oxides predicted from theory with that actually observed in the air of towns and cities.

Hydrogen sulphide is emitted from domestic appliances—the proportion varies with the combustion conditions and fuel size but may reach 20 per cent. of the total sulphur release in the worst case. The gas is not readily oxidized and is itself a dangerous poison. Although it has received little attention hitherto, it may play a significant part in the effect of atmospheric pollution on health. The deleterious effects of hydrogen sulphide on metallic and painted surfaces are well known, although it is probably less damaging in this respect than sulphuric acid.

At present there is no economically feasible method of removing the sulphurous constituents from industrial or domestic flue gases, although methods have been developed for flue gas washing at power stations. Owing to their enormous consumption of coal at a point source power stations offer a better prospect for successful operation of such processes than the smaller installations of industry. Parker has given a full account of these gas washing processes in a lecture to this Institution in 1957. A further recent development in this field is the work at Sheffield on the removal of sulphur oxides from flue gases by a dry method using granular dolomite.

There is more hope of reducing sulphur pollution in the case of domestic appliances. It is possible to retain most of the sulphur in the ash by incorporating alkaline additives in the fuel which react with the sulphur evolved to give sulphides and sulphates that are stable at the temperatures occurring in the fuel beds of domestic appliances. Investigations are being carried out in the B.C.U.R.A. under contract for the Ministry of Power. Experiments in which small pellets of powdered coal mixed with alkaline additives were burned in an electric furnace showed that over 70 per cent. of the coal sulphur could be retained in the ash even at 1,000°C. Practical tests on the open fire confirmed this result; 70-80 per cent. of the fuel sulphur was retained in the ash of coal briquettes containing 4 per cent. of lime when burned at a moderate rate. Another form of treated fuel—coke soaked in soda solution—was also found to retain a large proportion of sulphur in its ash when burned on the open fire. However, in both cases there was a reduction in fuel quality, largely due to the added ash, which makes these treatments unlikely to find ready acceptance.

During the study of sulphur release in domestic appliances considerable difficulties were experienced in analysing the flue gases for sulphur compounds. Not only were the flue gases extremely dilute (a typical concentration of sulphur dioxide was about 0·004 per cent.) but they were also subject to stratification in the chimney. There were also problems of volume flow measurement. These difficulties have been largely overcome by the use of an induced draught appliance where the normal brick chimney is replaced by a small diameter steel flue, draught being provided by a fan at the flue outlet. With this equipment the intake of dilution air is controlled, there is no stratification and accurate volume flow measurement is facilitated. It has therefore been found possible to follow closely the fluctuations in the pattern of sulphur release.

Perhaps in general the best way of minimizing sulphur pollution at present is to ensure that all forms of fuel are burned in the most efficient manner possible, thus releasing the minimum quantity of sulphur per useful heat unit. The B.C.U.R.A. has long been active in this field of fuel economy, both from the industrial and the domestic point of view. It is often said that oil has an advantage over coal in this respect but in fact there is little to choose between them when the use of heavy fuel oil is considered. Although the calorific value of this oil is about 18,000 B.Th.U. per lb. compared to about 12,000 B.Th.U./lb. for coal, the corresponding average sulphur content is 3-4 per cent as against 1-2 per cent for coal.

Paraffin oil, gas and electricity are the only fuels which do not give rise directly to sulphur pollution. However, it must be remembered that gas is normally accompanied by its by-product coke which will produce sulphur oxides when burned, and electricity produced from coal or oil at a power station will normally provide its quota of sulphur pollution at this point (although perhaps this is less serious as it is emitted from high chimneys).

Conclusions

In this paper we have discussed the nature of the pollutants and the amounts produced from homes and factories. We have examined the means at present available for minimizing the pollution and have studied the ways in which the research work is making its contribution. New data have been presented on industrial dust and smoke and on domestic sulphur. In Table V (reproduced) the quantity of pollution from domestic and industrial sources is given as percentages of the fuel burned. In each case the provenance of the data has been stated. A comparison is also made between the estimated annual pollution using these data and the estimate made by the Beaver Committee. It will be seen that our estimates of domestic smoke agree with those of the Committee but that our estimates for industrial smoke are much lower. This Table helps to provide confirmation of the oft-repeated claim that it is domestic smoke that is the villain of the piece.

Having surveyed atmospheric pollution as it exists at present, we now wish to see what changes are likely and how far developments will be influenced by foreseeable technological advances.

The only certainty is that improvement will continue but the actual course of events and the time-table followed must be dictated by the interplay of economic, social and technical factors.

When the Clean Air Act becomes fully effective dark smoke and coarse grit from industrial sources should become a rarity. It seems certain that old, smoky and inefficient appliances (particularly hand-fired boilers) will eventually disappear, and improved methods of dust and grit arresting be adopted as general practice; an increasing knowledge of dust and grit emission should lead to a gradual elimination of this source of trouble.

Fuel 1	User 2	Quantity of Fuel burned (1957) Millions of Tons 3	Pollutant 4	Quantity Emitted as % of Fuel Burned 5	Pollutants Discharged (Millions of tons) per annum	
					Based on Column (4) 6	Beaver Committee Estimate 7
Raw Coal	Domestic	34	Smoke	2-6 (*a*) (*b*)	1·0*	0·9
			Dust	Small?	Small?	0·1
			Sulphur Compounds	1-2 (*c*) (*d*)	0·9	0·9
	Industrial	63	Smoke	0·2 (*f*) (*g*)	0·1	0·8
			Dust	0·3 (*f*)	0·2	0·2
			Sulphur Compounds	1-2 (*h*)	1·8	1·8
Coke	Consumers other than Gas Works and Blast Furnaces	13	Smoke	Small?	Small?	Nil
			Dust	?	?	Small
			Sulphur Compounds	1-1½ (*c*) (*e*)	0·3	0·3
Fuel Oil	All Consumers of Fuel Oil for burning	6½	Smoke	Small?	Small?	Small?
			Dust	0·1?	Small	—
			Sulphur Compounds	3-4 (residual oils) (*j*) 0·7-1·0 (gas oils) (*j*) <0·1 (kerosene) (*j*)	0·4	0·3

* Taking an average of 3 per cent of fuel emitted as smoke

Legend

(*a*) L. L. Fox, *J. Inst. Fuel*, 1954, **27**, 385.
About twenty experiments on stool bottom and inset grates, in laboratory settings. One free-burning coal, burned at rates of 2-6 lb./hr.

(*b*) E. G. Lamble, B.C.U.R.A. Private Communication (B.C.U.R.A. Annual Report 1956).
Over 70 tests in laboratory setting. One test coal burned at rates of 1·4 to 3·5 lb./hr. Three different appliances. Effect of flue damper studied.

(*c*) J. M. Horspool and E. M. Norcross, B.C.U.R.A. Private Communications—Reports to the Ministry of Power (B.C.U.R.A. Annual Report 1956).
Experiments with one bituminous coal as well as cokes and low temperature carbonised fuels on an inset grate in a laboratory setting and also in an induced draught installation. Tests on a small hot water boiler burning Welsh dry steam coal, coke and low temperature carbonised fuels.

(*d*) P. H. Crumley and A. W. Fletcher, *J. Inst. Fuel*, 1957, **30** (Nov.), 608.
Tests on an openable stove installed in a calorimeter room. One coal and coke used. Variety of conditions including operation with doors closed.

(*e*) R. A. Mott and K. Parramore, *J. Inst. Fuel*, 1957, **30** (Mar.), 123.
Experiments with small hot water boiler installed in laboratory, burning coke only.

(*f*) P. G. W. Hawksley, et al., B.C.U.R.A. Private Communications (B.C.U.R.A. Annual Report 1957).
Work with the B.C.U.R.A. dust sampling equipment on a number of industrial installations—about 30 plants of which half had been subject to complaint.

(*g*) T. F. Hurley, Proceedings Edinburgh Conf. Nat. Smoke Abat. Socy., Oct. 1947, p. 17 (F.R.S. Tech. Paper No. 53, 1946).

(*h*) P. F. Corbett and W. M. Crane, *B.C.U.R.A. Bulletin* 1952, **16** (Jan.), 1.1.
Quotes values typical of large power station boilers, obtained in extensive field work. Borne out by results of Lenhardt, K. and Egenolf, W. (Staub, 1958, 18 (June), 169-173).
Reported work on three types of central heating boilers in Germany.

(*j*) Assuming that all of the sulphur in the oil is released.
(This is true for heavy oil fuels in power station boilers—from work of P. F. Corbett, *J. Inst. Fuel* 1953, **26** (Aug.), 92-106).

Domestic smoke will not disappear so rapidly. As smokeless zones multiply, the consumption of solid smokeless fuels should increase. However, although these fuels have a valuable part to play it must be recognized that they are unlikely to provide the whole of the domestic fuel requirements. A large manufacturing capacity would be required and the supply of low ash coals suitable for making smokeless fuels may not be adequate. In the long term, there may be a gradual disappearance of the open fire with the adoption of other forms of heating, a trend in line with an increasing standard of living. If electricity becomes cheaper with the advent of nuclear power and the more efficient power stations, this fuel is likely to play a more dominant role in domestic heating. Application of the processes for total gasification could lead to the increasing use of gas for heating.

Sulphur pollution is likely to be the last problem to be tackled. It may prove possible to apply new wet or dry sulphur removal processes to power stations and even to use these processes for the larger industrial plant. However, smaller industrial appliances present an intractable problem and any solution must await new technological advances. In the case of domestic appliances, the solution is likely to be similar to that of domestic smoke—the eventual replacement of open fires and stoves by other methods of heating. The burning of sulphur-retaining fuels could provide a partial answer but the application of this palliative would involve subsidising the fuel or extension of the Clean Air Act to deal with the sulphur problem. The public would not pay more for an inferior fuel merely because it did not emit its sulphur into the atmosphere. Such an extension of the Clean Air Act seems unlikely under present conditions; the traditional British method is to delay rigid legal demands until they may readily be complied with.

The two factors likely to have an important influence on future trends are the development of nuclear power stations and total gasification plant. In the former case a waste disposal problem arises but one quite different from those considered here. In total gasification small coal is converted by partial combustion with oxygen and steam into a gaseous fuel. The sulphur can be removed from this gas using well-established methods. This process is thus the only one which need not give rise to appreciable pollution at any stage. If these processes ultimately provide the bulk of the power load, the industrial pollution problem will be confined to sulphur from oil-firing and metallurgical processes. These latter may well prove to be the last sources of pollution to survive, unless research already in progress leads to dramatic new discoveries.

BOILER OPERATORS' CERTIFICATE

The City and Guilds examination for the above certificate consists of a written paper and a Practical/Oral test on the firing floor where the candidate works.

The number of men taking this examination has so increased that it was decided to hold several conferences of the examiners who conduct the Practical/Oral test in order to ensure a uniform approach and common standard throughout the country.

These conferences were held in April in Bristol, London, Manchester and Glasgow. They were well attended and the discussions brought out many ideas for future consideration by the Advisory Committee.

The chairman at all four conferences was our vice-president, S. N. Duguid.

The National Society for Clean Air has always enthusiastically supported efforts made for the training of stokers and is pleased at the increasing success of the movement.

F 16
NATIONAL SOCIETY FOR CLEAN AIR
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PREVENT AIR POLLUTION
CLEAN AIR
PARKER & DANNEN

The Society's Stand, which attracted much attention and many inquiries, at the recent Factory Equipment Exhibition at Earl's Court

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NEW CLEAN AIR JOURNAL FROM FRANCE

We are very pleased to welcome the publication of the first issue of the *Revue* de l'Association pour la Prevention de la Pollution Atmospherique (APPA). As reported in these pages recently the new Association has been formed by the representatives of a number of organizations in France concerned with or interested in air pollution and the creation of public opinion about it. The new journal is a quarterly, and is published by APPA at 62 rue de Courcelles, Paris, 8e.

The *Revue* (8vo, pp. 38) contains a number of authoritative articles, including an editorial by Professor Bugnard, a general survey of air pollution by Professor Raymond, an article on "Basic Principles concerning the Study and the Prevention of Air Pollution in Foreign Countries," by M. l'Ingénieur Général Avy, and a more technical study of the micro-estimation by infra-red spectography of carbon monoxide in the blood, with observations on the CO content of the blood of town-dwellers, by Professor Moreu. There are also reviews of publications and general information—including, we were pleased to see, a report on the N.S.C.A. Llandudno conference and an announcement about the forthcoming Diamond Jubilee Conference. The General Secretary of APPA, M. Queret, will be representing the Association at the Conference, and will be presenting a paper.

Meetings and Conferences

The number of meetings of various kinds, all with air pollution interest, is this quarter so considerable that a brief notice only of a few of these can be reported, with a few excerpts of some of the things said.

Nottingham Meeting on Iron and Steel

A new kind of conference, which proved to be highly successful, was held by the Society in Nottingham on 19th March, 1959. The purpose of the meeting, for which publicity was deliberately not sought, was to discuss air pollution problems from iron and steel works between representatives of the local authorities concerned and technical representatives of the iron and steel industry. Nearly thirty local authorities were represented.

The Chairman was Dr. T. P. Colclough, chairman of the Society's Technical Committee, and in the morning session short practical papers on the various pollution problems were read by speakers who had been invited through the Iron and Steel Federation. "Iron Making" was described by W. M. Larke, one of the General Managers of Stewarts and Lloyds Ltd., "Steel Making," by R. A. Hacking, Director of Research of Richard Thomas and Baldwins, Ltd., and "Combustion and Gasification Processes and the Measurement of Emission" by F. A. Gray, Fuel Consultant to the United Steel Companies, Ltd.

It had been emphasized that the meeting was to discuss the problems on a technical level only, and that the administration of the law, etc., would be inappropriate. The afternoon session, when the morning's papers were discussed, was most interesting and productive, giving rise to many questions and answers that, it was felt, were most useful in promoting a better understanding of the difficulties facing both the local authorities and the iron and steel people. Under the skilful chairmanship of Dr. Colclough the discussion remained on a practical and good-humoured level. The meeting was held in the Guildhall, by courtesy of the Nottingham Corporation, and at the end afternoon tea was provided by the kindness of the Health Committee of the City Council.

Conference in Essen

A conference in Essen of the German Society for Hygiene and Microbiology on 22nd to 25th April last, devoted one of its sessions to "Air Hygiene." Two of the papers were read by British visitors—our Past-President, Dr. R. Lessing, and Dr. P. Lawther, of the Medical Research Council's Group for Research on Atmospheric Pollution.

Dr. Lessing's paper was on "Experience in the Working of the New Clean Air Legislation in Great Britain." He gave a concise account of the events which led to the passing of the Act, described the main provisions of the Act and the progress that is now being made. Dr. Lawther's paper was on "Carcinogens in Town Air." After surveying the work that has been done in this field in Britain he concluded that "it is not unreasonable to infer from these data that air pollution may play some part in the causation of lung cancer, but there is no evidence on which it can be indicated as the cause of the spectacular rise in the incidence of the disease." There is probably less tarry matter in the atmosphere now than there was, and it has become fashionable to cast the diesel engine as a new source of carcinogenic material. But, Dr. Lawther pointed out, "there is an immediately obvious temporal weakness in this accusation: the increase in the use of diesel traction has been roughly contemporaneous with the rise in the incidence of lung cancer, whereas if this source were the cause of the disease, the effects would not yet be manifest."

P.H.I.s Discuss Smoke Control Areas

The London Centre of the Association of Public Health Inspectors discussed smoke control areas at a meeting on 29th January, 1959, when a paper on their creation and operation was read by G. W. Herrick, Chief Public Health Inspector for Fulham. He described the preliminary planning, surveys, estimating, and other features of the work involved in bringing a smoke control area into being, and concluded by summarizing some of the important lessons learned. These he gave as follows:

1. Administration needs careful planning and should become streamlined and routine as quickly as possible. The need for prompt payment of grants is stressed.
2. Taking sizeable areas rather than small and often isolated areas is recommended. This makes the Council's determination in the cause of clean air quite evident, prevents real difficulties in the distribution of solid smokeless fuels, and saves time of Councils and officers, and, I suspect, at the Ministry.
3. The public like the idea of clean air and are not—repeat not—unresponsive. Our efforts have resulted in the nearest approach to a fan mail I have known in over thirty years' local government experience.
4. Publicity in the area is best withheld until the date of confirmation. It is also possible to over-publicize and cause confusion. Reading matter is best kept at a minimum.
5. Many builders need educating in modern fixing methods. The work of the Coal Utilization Council and their training courses for building operatives is applauded.
6. Councils can easily get bogged down in the inevitable mass of detail. It is suggested that the best results are obtained when they make clear policy decisions as required and then let the officers get on with the job.
7. From our experience so far, smoke control orders work.

Mr. Herrick concluded on an encouraging note: "The absence of smoke in our No. 1 area as compared with the surrounding district is remarkable when observed from a high building. This pleasing result is despite the fact that many of the grates considered to require adaptation or renewal had not been the subjects of applications for grant."

Exemptions

The discussion on this paper was opened by W. G. J. Sutton, C.P.H.I., Westminster, who also had many interesting things to say, including some straight comment on the question of exemptions in smoke control areas. He said:

"I am against what might be called 'unlimited' exemptions, *i.e.*, one given for all time. In fact, I am against exemptions. There are however exemptions to the exemptions!

"Considerable pressure has been brought upon the City Council—and needless to say the Public Health Inspectors doing the job—to exempt underfeed mechanical stokers. The Ministry of Housing and Local Government asked the Council if they had considered this particular point. The City Council had, at least the Public Health Committee had, and went so far as to visit premises where such plant was installed. Following that visit the Committee considered the matter again and at great length. They again said *no exemption*.

"The Metropolitan Boroughs Standing Joint Committee considered the matter, on reference from the Ministry, as the Minister was considering making an exemption Order similar to the one for furnaces using liquid fuel. The M.B.S.J.C. said they were against making such an Order."

Bristol and West Committee

A meeting of the Bristol and West Clean Air Committee was held at the

University of Bristol on 23rd April to discuss the problem of "Radiation and Public Health." The main speaker was G. B. Courtier, Assistant Scientific Adviser, Public Health Department, London County Council, and the discussion was opened by the Medical Officer of Health for Bristol, Professor R. C. Wofinden, who was followed by E. G. Whittle, Public Analyst, Bristol, and G. W. Dhenin, Deputy Chief Public Health Inspector, Bath.

Earlier in the day the members visited the Corporation flats at Aiken Street, Barton Hill, to inspect the heating plant, and held their annual meeting.

Mr. Courtier referred to the establishment of nuclear power stations in the West Country, about which Bristol might have mixed feelings. But these stations were said to be increasingly safe, with no appreciable emission either to the atmosphere or to the river or sea. "These great ventures," he said, "are obviously all-important in our national and economic life. There should be nothing but praise and encouragement for them, but we who are engaged in the field of public health must be excused if we cast an anxious eye upon their activities."

The West Midlands Division

The West Midlands Division held its Ninth Annual General Meeting on the 23rd April, 1959, at the Birmingham Council House.

The Chairman, Mr. Councillor W. A. N. Jones, welcomed the 74 delegates present with special reference to Dr. J. S. G. Burnett, Chairman of the Executive Council, Ieuan Lewis, M.B.E., Chairman Publicity Committee, and the Director of the Society, Arnold Marsh, O.B.E.

The morning session included the business meeting, election of officers and the report of G. W. Farquharson, Honorary Secretary of the Division. The provisions of the Draft Bill "Certification of Furnace Operators" was introduced by the Honorary Secretary, and the open discussion with contributions from the many representatives and delegates drawn from the various organisations, trade union, and industrial associations, proved stimulating, and indeed favourable to some degree, but it was obvious that the Bill in its present form, whilst useful for discussion purposes, would require redrafting on certain points. It will be interesting for the Executive Council to receive the views of the Divisions on this important draft.

The afternoon session proved equally interesting, and excellent talks were given by Dr. Burnett, Mr. Lewis, and Mr. Marsh, each speaker dealing with activities and work within the scope of the Society, with interesting discussion on the many phases covered by the speakers.

The meeting closed with a Buffet Tea in the Banqueting Hall and a vote of thanks by Councillor Eric Gibbons was well received.

Glasgow Meeting

A remarkably well attended meeting was held in Glasgow on the evening of 11th March, 1959, under the auspices of the Scottish Division of the Society and the Scottish Fuel Efficiency Committee of the National Industrial Fuel Efficiency Service. Sir Patrick Dollan was in the Chair and the speakers were Dr. Ian MacGregor, Department of Health for Scotland, who spoke on "Smog and Health," W. B. Kennedy, Senior Smoke Inspector for Manchester, who dealt with "Smokeless Zones and Smoke Control Areas," Dr. Angus Macfarlane, Managing Director of N.I.F.E.S., on "Industrial Smoke and Grit Emission and Fuel Efficiency," and Arnold Marsh, Director of the N.S.C.A., on "Progress Towards Clean Air."

The meeting was called at an appropriate time—when Glasgow and the surrounding "black area" was still reeling from the effects of the severe fogs of the winter. Sir Patrick Dollan, in opening the meeting, said:

"The Clyde area has suffered a fog plague on 47 days and nights since November 10th. This is the worst experience in the history of Glasgow since 1909. Glasgow and Clydeside have been more affected by the blight than any other area in Great Britain. This indicates that the city has more to do to secure the abolition of smoke and fog than any other community in Great Britain. London, Birmingham, Manchester, and other cities in the South have also been stricken by fogs between November and February, but not to the same extent as Glasgow and Clydeside. Our November-February suffering of fog is the worst I can remember happening in Glasgow in 45 years experience of public life.

" A 24-hours fog day and night costs Glasgow at least £1,000,000. Glasgow must have lost about £20,000,000 between November 10th and the date of writing (February 17th). This represents the loss in production, cuts in wages, and overtime for employees, the restrictions on transport, and the decline in revenue for shops, warehouses, factories, and other centres of commerce. Fog costs the average household £1 a day in expenditure for laundry, the cleaning of curtains and windows, extra cost for fuel, electricity, lighting, illness and accidents and funerals. There are 321,000 occupied houses in the city, so that the biggest share of Glasgow's fog loss is borne by households, most of which are in the lower income groups. Fog also imposes extra drudgery on housewives and domestic servants.

" The new town of East Kilbride, less than ten miles from Glasgow, has had no smoke-fog in November, December, January and February. It is, therefore, a much healthier and more economic community than Glasgow. Although its tenants pay a little more in rent they save because of the higher standard of health and cleaner amenities.

" Glasgow, at the hour of writing, will have incurred over £20,000,000 in wasteful expenditure because of fog from November to February, more than would be required to provide all the industries, factories, shipping and houses with Clean Air Equipment and Services. Glasgow is not so healthy as Edinburgh, Dundee and Aberdeen because it has more smoke, dirt and fog than the other towns. One Fuel Engineer who lives in Inverness-shire informs me that curtains and other household drapery in his residence do not require to be laundered except once in five years, and he has produced evidence to prove that some drapes in the country could be kept clean for ten years because of lack of smoke and fog. What is possible in Inverness-shire may not be readily attainable in Glasgow, but the city could by sustained effort promote a clean air environment superior to that of any other industrial town in Great Britain."

MINISTERS ON CLEAN AIR

Lord Mills

Opening the Factory Equipment Exhibition at Earls Court on 7th April, the Rt. Hon. Lord Mills, Minister of Power, said:

" I am glad to know Clean Air has such a major emphasis in this Exhibition. It is not enough to introduce legislation on the subject, although that legislation in itself is noteworthy as the only attempt by any country in the world to produce a comprehensive system for dealing with the problem of air pollution. To make it a success requires co-operation from every member of the community and a real awareness of the evils of smoke pollution.

" Progress is being made and our aim must remain to achieve the maximum reduction in smoke emission whether by industry or the domestic consumer. We cannot afford to go on living in an atmosphere of smog and dirt. The fogs this winter have perhaps been a salutary reminder of the work that still needs to be done.

" For the domestic consumer, clean air means generally a change from using coal to the use of smokeless fuels.

For industry coal requires to be burned in suitable appliances which are well maintained and properly operated."

Mr. Henry Brooke

Speaking at the annual luncheon of Municipal Mutual Insurance, Ltd., in London on 30th April, 1959, the Rt. Hon. Henry Brooke, M.P., Minister of Housing and Local Government, said:

"If you live in a town, are you helping to win the battle for clean air?

"The Government are tackling industrial smoke and fumes. By 1963, when the period of grace under the Clean Air Act for modifying boilers and plant expires, there will be so little dark smoke from factory chimneys that we shall be amazed how till now we have taken blackness for granted and tolerated it.

"But fully half the smoke in the air comes from household chimneys, and it is the town or city council's job to tackle that. Up to date I have confirmed 115 smoke control orders put up to me by local councils, and I know of nearly 200 more coming along. Altogether they will cover 50,000 acres of smoky town. So far, so good. But it is not nearly far enough because the black areas where the worst air pollution is extend over two million acres.

"Some people fear there will not be enough good quality smokeless fuel as the smoke control areas increase, but that is wrong. I shall not confirm smoke control orders unless suitable smokeless fuels can be got. Over and above the branded fuels, measures are in hand to make available all over the country gas coke of the right quality to give a lively fire in a modern grate.

"People who say coke never burns well on open fires have probably been using the wrong sort of coke in the wrong sort of grate. There is no basis in science for the notion that an open coke fire means nasty fumes in the room. Fumes from coke and coal are almost the same, except that coke makes no smoke, and if a coke fire or a coal fire produces fumes in the room, get someone to look at the chimney.

"It is my firm resolve to press forward. I have asked all local councils in the black areas to speed up their smoke control plans and to let me have by the end of June their definite programme for the next five years.

"It will save money if we clean the air. What is more important still, it will save lives."

Lord Forbes

"Scottish local authorities have been very slow in making use of their powers under the Clean Air Act," said Lord Forbes, Minister of State for Scotland in Edinburgh on March 6th, 1959.

Lord Forbes was speaking at the Scottish premiere, organized by the South of Scotland Electricity Board, of the film *The Future is Electric*. He said that in the four weeks from the middle of January when fog was particularly bad the number of deaths from respiratory diseases in the seventeen largest Scottish towns was almost double what it was the year before. In Glasgow the story was worse—486 deaths as compared with 197.

Lord Forbes said that if the aim of the Clean Air Act was to be achieved, as much as possible must be done to get the co-operation of the public, by wise publicity, by showing that Clean Air was in the public interest. The public must be persuaded to make greater use of the smokeless fuels available whether for cooking or space and water heating. He commended the Scottish Electricity Boards for their enterprise in developing the use of electricity as a smokeless fuel in heating schools, large blocks of flats and commercial buildings by electric floor warming. There was no doubt that imaginative publicity of the kind they had seen would do a lot of good. The film would be a welcome addition to the forces fighting for Clean Air.

CONFERENCE ON CLEAN AIR

Feature of Factory Equipment Exhibition

A TWO-DAY conference on clean air was held at Earls Court, London, on 13th and 14th April, in conjunction with the Factory Equipment Exhibition. The conference was opened on the morning of the first day by Mr. Gerald Nabarro, M.P. In introducing Mr. Nabarro, the Chairman, Mr. Hector McNeil (Managing Director of Babcock and Wilcox), said that as far as the conference was concerned the most happy circumstance of having Mr. Nabarro there was that it was he who initiated the Clean Air Bill. He said: " It was taken over by the Government and put through as a Bill, but all the credit for having started the activities in Parliament really belongs to Mr. Nabarro." (It should perhaps be pointed out that the Society also had a hand in the promotion of the Bill, by assisting Mr. Nabarro.)

Mr. Nabarro, in his speech, outlined the history of the Clean Air Movement. In speaking of the abolition of domestic smoke, he said that Mr. Duncan Sandys had coined rather a nice phrase during the debates on the Bill, when he said that Mr. Nabarro expected to accomplish a revolution at the fireside in a matter of a few weeks. Mr. Nabarro continued:

" I did not really expect to do anything of the sort, but I think the term ' revolution at the fireside ' is a good one. We could not expect to change the whole of the fuel-burning habits of the British nation. You know how difficult it is to change anything in this country, let alone change anything as fundamental as the fuel the Englishman uses in his home. A revolution at the fireside has got to come gradually."

Speaking of the type of action needed to educate the public, and so ensure the implementation of the Clean Air Act, Mr. Nabarro said: " Abundant leaflets, pamphlets and articles in the Press, exhibitions and demonstrations, will all help. I know you share my enthusiasm for the pressure being well maintained. The development of clean-air—a policy and the implementation of that policy on a national scale—will greatly be helped by the exhibitions of the kind which we have here for another week. I hope that the Exhibition itself will be a progenitor for many more; and the Conference also."

A pretty clear endorsement of the Society's activities, and in particular of its Conferences and Exhibitions.

The first of the paper speakers was S. H. Clarke, the Director of the Warren Spring Laboratory (formerly the Fuel Research Station). Mr. Clarke described the findings of the Beaver Committee, which he illustrated with a number of slides. He then turned to what had happened since the introduction of the Clean Air Act, and continued:

" In the first place, you will see from the table which I have shown you that there was substance for the conclusion of the Beaver Report, that about one-half of the smoke liberated comes from domestic sources and the rest from a variety, of which industry was the second. But that is the total emission of smoke. My colleagues have been looking more carefully into the occurrence of smoke down at ground level, and they have reached the conclusion that it is substantially more than half. Maybe 60 or 70 per cent. of the smoke which occurs at ground level comes from domestic sources. Another thing they have found is that if you examine the intensity of smoke in various parts of the country you find that it is not simply in the heavily industrialized areas that there is the most intense smoke. This, I think, is one of the most interesting conclusions which they have drawn."

Another interesting finding was described by Mr. Clarke in a passage in which he said that:

"Since the Clean Air Act began—and action had already been taken by some local authorities before that time, as you know—there has been a marked decrease in the occurrence of both smoke and deposited matter but not in sulphur dioxide. I have here a list which includes places like Leeds, Kearsley, Glasgow, Sheffield—it is quite a long list—in which this decrease has been noted. My colleagues have written to and visited a number of these places trying to find the explanation for this. In a number of instances the local authorities concerned have been able to point to individual undertakings which have installed new equipment and have moved from the consumption of coal to that of oil; and to housing estates in which smokeless fuel is being burned."

The Quantity of Pollutants

Mr. Clarke was followed by Dr. A. Parker, former Director of the Fuel Research Station. After a brief introduction concerning the immediate history of the Act, Dr. Parker spoke of the estimates made by the Beaver Committee concerning the quantities of pollution and the damage caused by it. He said:

"Mr. Nabarro told you that the cost of the damage to the country, excluding damage to health, was estimated by the Beaver Committee at £250 million per year. Some members of the Committee have gone into the matter again, and they have come to the conclusion that the £250 million per year is, in fact, a substantial understatement.

"I come now to quantities of pollutants. I should like to tell you, of the basis I have always adopted, the quantities emitted in 1938, a pre-war year. In 1938 the total quantity of smoke emitted estimated for this country was 2·4 million tons a year; grit and dust 0·6 million tons from the use of fuel, excluding cement factories and other factories; sulphur dioxide, five million tons. In 1957—that is the last year for which there are published statistics on the use of fuel—the smoke was down to 1·8 million tons against the 2·4 in 1938. This figure I know does not exactly agree with Mr. Clarke's but they are on the same basis—the two I have given you. In 1938, more than half of the smoke came from domestic appliances. In 1957 as near as one can tell, half came from domestic heating appliances. The grit and dust discharges is now greater than in 1938 because of the greater use of pulverized coal, higher velocity furnaces and so on; and the sulphur dioxide is higher, it is five and a half million tons, because more fuel is used.

"In 1938, the total amount of coal used in this country was just under 180 million tons, of which 48 million tons were domestic, including five million tons for the miners. In 1957 we used 210 million tons of coal, of which only about 35 or 36 million tons was domestic. So the domestic use of coal has gone down since before the war by a good 13 million tons. That was due to the rationing of coal, but the consumer used nearly as much total fuel because he made up for it by using gas and electricity, and now in addition oil.

"That will just show you that by the change over to refined fuels we have already cut down smoke considerably, and I am hoping that that change to the more refined fuels—gas, electricity and oil—will continue."

Speaking of regulations making it compulsory for industry to install instruments for measuring smoke, Dr. Parker said: "So far no such regulations have been issued, but I do not think we are far off having instruments and being satisfied that the instruments could be readily installed. In this case, the Minister may decide to make regulations insisting on such instruments."

On the other hand, concerning the emission of dust and grit, he said:

"The Minister can make regulations whereby if the local authority requires it instruments for measuring the discharge of grit and dust from a chimney must be installed and the results made available to the local authority. Frankly I think it will be some time before the Minister attempts to make any such regulations in relation to grit and dust. This is not a very easy matter."

Dr. Parker's paper was followed by a very interesting discussion, and a number of questions were answered by both speakers. One answer by Dr. Parker which was of particular interest concerned planning. He said:

" On this question of where blocks of flats or other buildings are built nearby, that is an important point and it means the local authority has got to look ahead in its planning. I know of cases in the City of London where commercial buildings have been built and there's one instance where a chimney comes out of the top of a building which is centrally heated and they have put another building next door. I do not care what you do, none of the waste gases is pleasant to breathe, but they are blowing into the windows of the new building. That is bad planning. If they want to make the other people put a higher chimney that should come on to the cost of the new building which is higher, or the local authority has got to do something about it. It would be unfair, having agreed to certain conditions, to expect the industrialist or the builder of the blocks of flats to extend the chimney."

Smoke Measurement

The afternoon session of the Conference on the same day was held under the Chairmanship of Captain W. Gregson, Chairman of the Fuel Efficiency Advisory Committee. The first speaker was M. F. Perkins, of I.C.I. Ltd., on " The Measurement of Smoke." He described the various systems of smoke indicators and alarms which are available, and their particular costs. Since the latter will probably interest many, this is what Mr. Perkins actually said:

" The cost of a simple smoke viewer will vary from between £15 to £35 for one simple Shell-type boiler. The simple smoke alarm which just rings a bell costs £60 to £80 and the smoke alarm with a simple event recorder which marks the time when the alarm is rung but gives no indication of the degree of exceeding Ringelmann 2 costs £90 to £110. The price of a smoke alarm and continuous meter indicating percentage obscuration ranges from £90 to £140. Continuous recording equipment which backs up the smoke alarm and indicator will vary with the type of recorder used. The strip-chart type of recorder is very popular with many manufacturers. This will cost £160 to £210 complete. Some people prefer the 24-hour circular chart which is in the same sort of price range of £140 to £240. Finally, the indicator/recorder —one combined instrument—which costs £145 to £270.

" These figures are in fact obtained from quotations of a representative number of better-known manufacturers of such equipment. I would not like to say that you cannot buy a smoke viewer for less than £15 or that one would not find oneself paying more than £270 for smoke alarm indicator/recorder, but that is a guide.

" It will be seen from this that the cost of equipment suitable for a plant consisting of five Shell boilers linked to a common flue, consisting of one smoke alarm in this flue and separate simple viewers for each boiler, will be of the order of £150 to £250."

Mr. Perkins ended with another interesting piece of information:

" Finally—this subject was in fact raised briefly this morning although addressed to a different type of user—I feel that I should mention the fact that the British Petroleum Company has developed an instrument designed for measuring the smoke emitted from diesel engines. The instrument operates on the photo-electric principle common to the equipment described earlier. This is a portable device and is definitely suitable for use in garages —I believe London Transport are reported to be using these now—

primarily to check vehicles before going on the road for engine maladjustment. The equipment costs about £90 and is now in production.

" It is the Road Traffic Act rather than the Clean Air Act which at present legislates against pollution of the atmosphere due to the exhausts emitted from road vehicles but it is good to know that here at least is equipment which can be adopted by enlightened operators of diesel vehicles to combat this menace."

Mechanical Firing

The second paper of the afternoon was given by M. V. Murray, of Wm. Cory & Son Ltd., on " Types of Mechanical Firing Equipment available for Shell Type Boilers." Mr. Murray described the various types of mechanical stoker, including the sprinkler, coking, chain-grate and underfeed types. He described the suitability of each type for different purposes, different boilers and different kinds of coal, and their relative costs. He wound up by saying:

" When it comes to installing new solid fuel firing equipment, it obviously does boil down to questions of economics. The more versatile and the more efficient firing appliances, I think, tend to be more expensive. Therefore, if your plant is old and has limited life and if you have, in fact, a most suitable and cheap fuel on the doorstep which you know can be burned by one of the cheaper appliances, there is not the slightest reason to go for an expensive appliance such as the chain grate. However, I do not think it is possible to make a sweeping generalization about installing a new appliance. It must be a question of going into it in each individual case.

" If you wish to avoid manual interference and can, in fact, avoid manual attention to the firing appliance then it is an obvious case where automatic control, certainly instrumentation to a high degree, is well rewarded."

The set papers were followed by several case histories of boiler houses which had been converted to mechanical firing and had cured their smoke problem. These case histories were followed by discussion in which a number of interesting questions were raised.

Grit and Dust

The Conference opened on the morning of the 14th with a session on the Arrestment of Grit and Dust. The Chair was taken by T. C. Bailey, President of the Institute of Fuel. The first paper, on " The Measurement of Grit and Dust," was given by T. F. Hurley, formerly Chief Research Engineer of the Fuel Research Station. Mr. Hurley began by pointing out that: " In this country the recognized method of measuring grit and dust emission is that laid down in British Standard 893: Method of Testing Dust Extraction Plant and the Emission of Solids from Chimneys of Electric Power Stations, which was drawn up in 1940. The Committee which drew up this specification to my knowledge spent several years of very intensive discussion and very extensive experimental work before it dared to put a specification forward. But in spite of this the specification was—and for that matter still is—subject to a great deal of adverse criticism. Nevertheless it is still the recognized and standard method.

" The chief criticism of this specification is that the method of test is somewhat complicated, but it must be remembered that it was drawn up for tests on power station dust extraction plant for which a very high order of accuracy is required. For the purpose of the Clean Air Act such a high order of accuracy is not necessary and, therefore, when the Beaver Committee drew up the recommendations upon which the Clean Air Act is based they included a recommendation that the British Standards Institute should be invited to draw up a new and simpler—although possibly less precise—specification." After discussing further attempts to obtain reasonably accurate results without using complicated methods, Mr. Hurley said:

"To sum up what I have said so far, if one wants a really high order of accuracy then the only thing to do is to follow the practice laid down in the specification 893 and do multi-point sampling. If you want to deal with load and do simple sampling then you can possibly use a single point if you take sufficient precautions to even out the flow. But this high accuracy is not always required. Single-point sampling has its merits when one does not want to have a precise figure, as one does in an acceptance test, but when you are checking the effect of making some alteration in the method of operation of, let us say, the stoker plant, or the effect of having a dust separator, and one wishes to know whether the performance of the dust separator is being maintained over a period of months, in that case a suitably-selected point will give the comparative results which are all that are required. As a compromise one can adopt single-line sampling, and that is the one which I think will be adopted by most factory engineers, and one can do that if one exercises a considerable amount of know-how in the selection of the line. Without this experience and without this judgement the results can be very much in error."

Mr. Hurley then devoted the rest of his paper to a description of the various kinds of techniques which could be adopted, and the kinds of filters and other apparatus which could be used to fit various working conditions.

The second paper of this session was given by R. H. Thompson, of Lever Brothers, on "Methods of Arresting Grit and Dust." Mr. Thompson dealt with the various methods which were available to the smaller industrialist in dealing with grit and dust. Perhaps one of the most significant things which he had to say, from the clean air point of view, was:

"There is a certain amount of self interest in this matter; any works engineer would prefer not to produce grits because, let us face the fact, in all but the smallest factory, the greatest majority of the grits fall on your own premises and contaminate your own product. So the works engineer is anything but popular with the production management due to the fact that grits from the chimney do get into the work rooms. In summer weather it is not practicable to open the roof lights because grits come down and contaminate the product. Therefore, there is a lot to be said on this, and figures were given yesterday of the savings under the Clean Air Act, £250 million, £300 million, what you like, and possibly quite a lot of it does not include the damage at present caused within our own factories to our own products from our own boiler plants."

These papers were again followed by case histories and an interesting discussion, which space prevents us from recording.

Planning

The last session was concerned with "Planning New Plant and Factories in Relation to the Clean Air Act." The Chair was taken by Professor M. W. Thring, of the University of Sheffield, and papers were given by R. Williams, Chief Public Health Inspector of Coventry, and H. C. Hawkins of BX Plastics, giving the local authorities' point of view and the industrialists' point of view, respectively.

Among the points made by Mr. Williams was one concerning the need for careful planning by the architects of a new factory, as follows:

"But even in my modern City of Coventry there are instances where new buildings for factories and other purposes have been erected which, although admirable in every other way, have been a source of serious nuisance to the surrounding areas. Apart from any offences caused to neighbours, as it were, there are too a number of occasions where, with a little more thought, those occupying the buildings themselves would not be faced with the view of a short chimney blackened on all sides and would not suffer from the emissions which come from it. This is something people outside would not see, but those inside have to grow accustomed to it. It seems to me, therefore, most opportune today to try to establish a closer link between us at the earliest planning stage, between, if you like, the industrialist, the architect and the public health officer. I feel that if we do this much of the future frustrations for all of us would be avoided."

Another point made by Mr. Williams was that industrialists concerned with the use of fuel were not being especially victimized:

" You are not being selected as industrialists for special attention; food premises have to notify us when they are going to be used and many other forms of special types of work have to notify us as well. There is nothing particularly unusual about the fact and we suggest you must now follow the same procedure."

Mr. Hawkins started by being extremely provocative, stating that the introduction of the Clean Air Act was precipitate, and that it would price the small industrialist out of the export market. However, it would seem that his bark was worse than his bite, for he went on to say things that have been said by Clean Air enthusiasts for years, as can be seen by the following quotations.

On instrumentation: " You want an instrument measuring the draught of the boiler outlet and you want another one at the economizer outlet, assuming you put in an economizer, which I would expect you to do, it is a first-class piece of equipment. I would like to measure always the CO_2 content of the gas. I do not go in for the more modern things, but I like to measure the CO_2 content of the gas. I consider it is an essential in any well run plant to know which way you are going. Then, of course, since the Act I include in my list of instruments, a smoke density indicator or alarm of some sort. I prefer the alarm because it is not much good looking at the chart the following day and say, ' By jove, we made a lot of smoke yesterday. We burned our coal badly yesterday.' It does not get you very far. You want to get an alarm which will irritate the boiler operator so that he will sit up and take notice and correct the condition. He will get more efficient combustion and you will not make smoke."

On boiler operators: " The other thing with planning which I think you have to consider is the training of boiler operators. I think that is a vital thing. . . . If you do train your boiler operators pay them according to their worth."

The session again ended with discussion and it can be seen from these quotations that the whole conference was a very useful and informative study of the main technical considerations involved in putting the industrial side of the Act into operation.

52nd Meeting of the Air Pollution Control Association

The Air Pollution Control Association will hold its 52nd annual national meeting at the Statler Hilton Hotel in Los Angeles, California, from June 22nd-26th. The 75 papers which have been prepared for presentation at the 15 general and technical sessions cover many different aspects of the problem of air pollution—health, air monitoring, land use zoning, pollution from motor exhausts, source testing, natural pollution and the disposal of wastes. Their authors have been drawn from more than fifty separate organizations, including universities, research institutes, consulting firms, private corporations and air pollution control agencies.

The Air Pollution Control Association is the only technical society in America concerned solely with the problem of air pollution and its control. It has its headquarters in Pittsburgh. Members are drawn from industry, government, universities, research institutes and consulting firms.

TO END DIESEL POLLUTION

IN the mounting worldwide concern at the ever-increasing problem of air pollution the diesel engine has come under heavy fire.

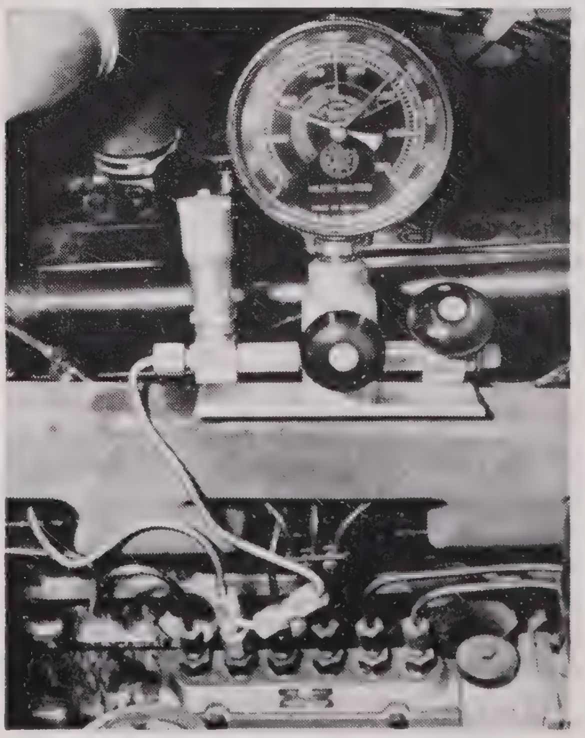
Official and semi-official reports, newspaper correspondence and articles in the technical and general press in many countries bring out a marked variety of solutions to this particular aspect of the question. Filters, catalysts and the altered position of exhaust pipes are the most usual remedies advocated. But logically there is one essential thing to do—to consider for a moment whether what is known as the Diesel cycle *needs* to cause such pollution and whether simple mechanical means exist to render the compression-ignition system truly efficient even in the hands of the most average of operators and thereby to reduce the objectionable exhaust. Large operators blame small operators and maintenance men blame drivers. In fact, however, the characteristics of smoke-free operation are to be found in the basic requisites of a " balanced " fuel injection system.

The efficiency of the diesel engine depends largely on correct fuel combustion. The factors governing this are the correct operation of the fuel injection system and sufficiently high compression in the cylinders. If either of these factors are not correct combustion will be incomplete, with a consequent loss of engine power, wastage of fuel, smoke, uneven running, excessive vibration and engine noise, a tendency to stall when idling, difficult starting and engine wear.

The fuel injection system depends for its proper operation on the pump which accurately meters the exact quantity of fuel required and at the correct moment delivers it to the injectors at the necessary high pressure for correct atomization. It also depends on the injectors which open at a given pressure and distribute the fuel in the cylinder in the form of a fine spray. The intimate connection between pump and injector means that no engine can be considered correctly adjusted when the injectors have not been *balanced to the pump in question under true operating conditions.*

Diesel engineers have long recognized that the ideal method would be to set injectors to the fuel pump dynamically—that is to say on a running engine rather than on a neutral hand pump, where many vital factors differ.

With the development of electronic testing, the research departments of most up-to-date diesel engine manufacturers are now establishing recommended injection pressures on prototype engines by the dynamic method. The Oscillograph can also carry out tests on the fuel pump under operating conditions. But it is now also possible to carry out the testing and resetting of injectors and the testing of pump elements and delivery valves dynamically on the engine in all maintenance workshops. The fact of testing under



Diesel Test in Progress

true running conditions means that faults can be accurately and quickly traced without unnecessary removal of the various components of the fuel injection system, with a consequent saving of man hours, load time, demurrage and specialist charges. Therefore, to take, for example, a standard six-cylinder engine, the time taken to check the delivery valves and elements of the fuel pump, to carry out all necessary tests and to reset the pressures on the injectors, and to take compression readings of each cylinder, is reduced, on an average, to an hour and a quarter. This estimated time does not, of course, include the correction of faults other than injector pressures.

When an engine is set up and corrected by this means it will be found to show an increase in power and engine life, smoother running, improved fuel consumption and no black smoke.

When the system of testing under operating conditions is used to reset injectors direct from the pump elements from which they are required to operate, it will almost always be found that the readings obtained are different from those obtained by bench setting, often by as much as 5-15 atmospheres. The reasons for this are as follows: (*a*) Bench testers have fixed diameter plungers which cannot be altered to suit the various sizes of plunger fitted to different types of engines; but when testing injectors on the engine the correct element or plunger is used; (*b*) Different fuels will give slight variations in nozzle setting pressure and therefore by using the normal fuel on which the engine is run these differences are eliminated; (*c*) Temperature changes are non-existent when injectors are adjusted with the engine running as the injectors are at normal working temperature; (*d*) Under working conditions the operation of an injector is affected by the following factors which are not present in bench testing: the condition of the delivery valve seat, the injector seat, the cut-off of the delivery valve and the condition of the plunger.

Variations caused by delivery valve seats can best be illustrated by the dynamic setting of an injector to the right pressure and then replacing the relative delivery valve and seat. Differences of as much as 5-15 atmospheres in injection pressure are often recorded, even when both delivery valves and seats are known to be in good condition. Where the cut-off of the delivery valve is worn the injector is overloaded, but with dynamic testing this effect can be minimized in operation if the wear is not too great. With dynamic testing and tuning, allowance is automatically made for small differences caused by wear in the element, delivery valve or injector on any given engine, so that the injectors are functioning correctly to their normally associated fuel pump.

Smoke in a diesel engine is a sign of inefficiency. Only an efficient diesel engine will give the maximum advantages which the more efficient fuel combustion has to offer—greater power, longer engine life and more m.p.g. at less cost. By eliminating the wastage of unburnt fuel indicated by black smoke fuel bills are automatically reduced.

Although diesel exhaust smoke is of various types, the main divisions are as follows: White Smoke—caused by unburnt fuel when the cylinder compression is too low. Blue Smoke—caused by bad compression, i.e. worn piston rings causing lubricating oil to pass and mix with the fuel at combustion. Blue smoke also appears after tick-over or on acceleration after coasting down a long hill when oil is drawn in by suction between a worn guide and an inlet valve. Light Grey Smoke—caused by poor compression (as blue smoke above) and by low injection pressure (excess fuel passing through the injector). Thin Black Smoke—caused by low injection pressure (excess fuel passing through the injector). Heavy Black Smoke—this condition is found mainly on hills or under heavy load and is caused by over-calibration of the fuel injection pump. This can be considerably minimized by balancing injectors to their own pump. Complete cure is possible by re-calibration of the pump.

It should also be noted that: (i) Low injection pressure means that injection is in advance and takes place over a long period. (ii) A worn injector needle can produce a solid stream of fuel instead of a good fine spray, resulting in poor or bad atomization—there then being too much fuel to be dealt with by compression in the cylinder. (iii) Noise is often accounted for by injection pressures being too high.

In general the worst conditions of exhaust emission are found when a vehicle is heavily loaded on a gradient. It should also be noted, however, that a large percentage of the diesel engines to be seen on the roads, even though they are not emitting obvious black smoke, are nevertheless emitting an amount of smoke, gases, solids, etc., far in excess of what could easily be achieved by proper maintenance with up-to-date equipment.

It has been shown that when engines emitting black smoke are tested the injection pressure is always 10-20 atmospheres low. But when this condition is corrected and the injectors are balanced to the fuel pump, then the smoke is eliminated. The exception to this is when the cause is excessive over-calibration of the fuel pump and even in this case the black smoke is minimized to a very considerable extent.

This may seem an improbable claim but it has been substantially and conclusively proved by engine manufacturers.

In a recent publication by The Mobil Oil Co. Ltd., entitled " Road Diesel Smoke Consideration," reviewed in the Spring issue, No. 109, of this journal, the conclusion is drawn that " the mechanical condition of an engine and adjustment of its fuel injection equipment overshadows any other factor or combination of factors relating to exhaust smoke." In view of new equipment with which it is possible to achieve a state of perfect " balance " a re-appraisal should be made of fuel system maintenance methods throughout the wide field in which Diesels are employed.

To argue that Diesels should be abolished is unrealistic. The Diesel is the horse of today and will be with us in fast-increasing numbers for many years to come. Diesels need *not* smoke, and as a fifteenth-century schoolmaster, one Richard Mulcaster, so truly said: " If abuse of a thing which may be well used be a sufficient condemnation to the thing that is abused, then let glotonie forbid meat, distempering drinke, pride apparell, heresie religion, adulterie marriage, and why not, what not."

Miracle Over E.C.4

Under the above heading the London evening *Star* of 6th December paid a tribute to those who work to clean London's air. The *Star* said, " We who work in Central London must not get so blasé as to ignore a miracle. But the fact is that while suburbs and countryside have been plunged in thick fog, the centre of this capital has been miraculously clear. On some days when it has been all murk five miles away, a faint but discernible sun shone on Fleet Street. It is no use writing off this miracle as a freak of nature. It lasted for nearly a month."

" The truth must be that the latent heat rising from the heart of London, the City's Clean Air activity and the greater use of smokeless fuels all played a part. We would, therefore, like to say thank you to the officials who planned, the managements who adopted and the stokers who worked the new techniques which helped to keep workers warm and the smog away. And we hope their work spreads."

The Use of Small Coal in Industry

by

J. N. Williams, M.I.C.E., M.I.Mech.E., F.Inst.F.

Extracts from a paper to the Institute of Fuel, London, on 11th February, 1959

Introduction

COAL production and use do not fade from the news for any length of time and are prominent at the moment on account of the National Coal Board's need to sell small coal to industry.

This situation and the advent of the Clean Air Act are not unrelated and the present intention is to show that a readiness to adapt plant to burn small coal in no way conflicts with the new Act.

This may appear at first sight to be a controversial statement and it is conceded immediately that the burning of high-volatile small coal in the old-fashioned domestic grates results inevitably in much smoke emission and that the general result is unsatisfactory. Yet the use of this same coal in the circumstances prevailing in industry could be most satisfactory and could comply with the requirements of the Act.

Over the past few years large coal production has been falling at the rate of about 1 to 1½ per cent per annum, mainly because of the rapid increase in the mechanization of the mines.

It is fairly evident that, if total production remains substantially the same, the decline in the quantity of large coal will be made up by an increased proportion of small coal of which only a very small proportion will be found as graded coal.

According to the Paymaster-General, and on the assumption that industrial productivity expands at the rate of approximately 3½ per cent per annum. it is estimated that by 1965, the energy requirement of the country will be equivalent to about 300 million tons of coal, compared with 250 million tons in 1955. However the general energy situation may develop, coal will remain for many years by far the main source of energy supply in this country and there can be complete confidence that requirements will be met but, at the same time, it is obvious that large coal will be scarce.

Large and Small Coal

A certain amount of prejudice may first have to be overcome. Too frequently industrial small coal is regarded as "dirty" but where washed smalls are involved this is a mistaken view. Some coals contain a high proportion of fines and others, such as the surface-worked coals and soft or brittle coals, make fines very readily. Such fines are not necessarily of lower calorific value and are frequently just as valuable as the larger coal.

The size consist of a coal is basic and may affect such subsidiary properties as: the amount of ash, the fusion temperature of the ash, caking and swelling tendencies of the coal, flame length, riddlings, boiler fouling and overheating of coal stocks.

It is generally assumed that, as mined, smalls may contain a relatively high proportion of mineral matter, but this generalization may not always apply. During 1957, 46 per cent of all coal supplied consisted of smalls, of which roughly half were treated, the ash content being 7 to 10 per cent. The untreated smalls had an ash content of 14 to 19 per cent. Smalls made by the breakage of soft parent coal tend to be low in ash. If, however, the coal substance is harder than the mineral matter the converse is true.

A high percentage of ash in smalls is objectionable when accompanied by a low-ash fusion point and when associated with a high rate of heat release. The greater the quantity of ash, the greater the possibility that the fusion temperature is relatively low. At high rating, a coal containing a high proportion of ash would necessitate more frequent cleaning of the ash-pit, this in turn increasing labour costs and reducing both boiler output and efficiency.

The fusion temperature of the ash in smalls may be lower than in correspondingly larger coal if the percentage is excessive, because there is more probability of unfavourable compounds such as sodium, lime and iron being present to act as fluxes. The effect of such fluxes is greater under conditions in which there is a shortage of air.

Caking and swelling tendencies are more marked in smalls, but the place for smalls which cake strongly is not the grate but the retort or oven. The technique of wetting should, however, reduce this adverse tendency considerably.

Higher ash contents tend to reduce the caking and swelling characteristics.

In certain cases, the use of large coal is regarded as essential because of the conviction that the necessary long flame can be achieved only by the use of such coal. This point of view is a little difficult to accept for several reasons.

The large coal would be hand-fired, with all the cyclic variations in the release of volatiles which hand-firing implies. The temporary benefit of intense radiation would constitute only a short phase in the hand-firing cycle. The same quantity of volatile matter is set free whether the coal be large or small and a long flame is more likely to be caused by slow mixing of secondary air with combustible gases. This might well take place with large coal because less draught is required to induce primary air through the fuel bed, and hence to draw secondary air through the firedoor grill.

The greater surface-to-volume ratio of small particles would seem to favour their rapid ignition and it is indeed true that smaller fuel can often be ignited more easily than large. The extreme case of pulverized fuel is an example of this. On the other hand, it is well known that large coal ignites and burns very rapidly in a locomotive firebox, but large pieces rapidly " craze " and break up into much smaller pieces and although these remain attached to the parent lump they do in fact present a large surface area to the combustion air.

Where flame radiation is important, there would be no appreciable difference in the emissivity in the two cases. Flame temperature is the most important factor in this respect and it is possible to obtain the characteristics required by control of the mixing of air and combustible gases.

Fines may be lost to the ash-pit by direct passage between the grate bars. While the proportion of fines in large coal may be relatively low, hand-firing implies firing tools and hand cleaning and it is during these operations that such " riddlings " are lost. This kind of loss can also take place with mechanical stokers and those stokers which require the fuel bed to be disturbed are at a disadvantage in this respect. Riddlings tend to be more copious with free burning than with caking coals.

The loss of fines to the ash-pit can be reduced by firing coal with the correct amount of moisture and by close air spacings in the grate.

Surface Moisture

The influence of surface moisture in the burning of smalls is important. The burning of dry smalls on a grate at useful combustion rates and with reasonable CO_2 is impossible. Much valuable research into this problem has been carried out by the B.C.U.R.A. The fact that added moisture has to be evaporated in the furnace is of minor importance when compared with the vastly improved combustion conditions.

D. C. Gunn has shown the effect which surface moisture has upon the burning of smalls. In the case of a boiler using rank 301 coal $\frac{1}{2}$ to $\frac{1}{8}$ in., over a range of total moisture content from 1·2 to 10·1 per cent, the boiler efficiency varied between 71 and 76 per cent. It seems, therefore, that the surface moisture had but little effect on the coal graded $\frac{1}{2}$ to $\frac{1}{8}$ in. But in the case of the same rank coal graded $\frac{1}{8}$ in. to zero, over the range of moisture content 1·8 to 20·8 per cent the boiler efficiency varied between 46 and 74 per cent, the lower efficiencies being obtained with the lower moisture contents. Gunn notes that, with fine, dry coals, output was restricted by the low efficiency, and that attempts to fire more coal resulted in an increased discharge of partly burnt coal over the rear end of the stoker. The optimum total moisture content for this coal and grade appeared to be about 11 to 12 per cent, the inherent moisture being rather less than 1 per cent.

Mechanical Firing

A change to mechanical firing involves a number of new characteristics in the constitution of the fuel bed and it is first necessary to examine why this is so.

The disadvantages of hand-firing are that it is a cyclic and inadequate. Even at its best—and good firemen are scarce—it must give place to the machine, in " quality " and in " quantity." The quality of the fireman's work suffers because he has to fire through an open firedoor and although a good fireman is careful to reduce the tendency for surplus air to enter the furnace during firing, the frequency of firing can be such as to defeat his efforts. At a given rate of primary air supply, the secondary air requirements vary continuously during each firing cycle, another variable with which the fireman has to cope.

The distribution of the coal on the grate is a matter of fundamental importance as the thickness of the fire at any point has a great influence upon the rate of the air flow through the fuel bed at that point and therefore on the local rate of combustion. Where the local rate of combustion is high, bare patches will be formed and surplus air will readily find its way into the furnace.

The hand-firing of large coal is usually associated with thick fuel beds; 6 in. is generally accepted as good practice but the figure will depend upon the average size of the fuel, thicker beds being required with larger fuels.

The uniform hand-firing of a fuel bed is a difficult operation if only because of the inability to see clearly what is happening at the rear of the grate, some 7 feet distant from the fire door.

An unevenness in the level of the fuel bed of, say, 2 in. would be very unsatisfactory in a bed 4 in. or 5 in. thick. The thicker the fuel bed the less important this unevenness. Consequently, a good fireman carries a 6 in. fuel bed to accommodate the inherent imperfections of hand-firing.

When mechanically fired, smalls should generally be burnt in a thin fuel bed, say 4 in. thick.

There are fundamental reasons why certain types of mechanical firing are an advantage for burning smalls. These include the elimination of cyclic hand-firing, a potentially higher efficiency and increased boiler rating and the possibility of obtaining those basic conditions which make automatic control possible. Another important advantage is that it is possible to achieve stable conditions which can be trimmed so that smokeless combustion (within the meaning of the Clean Air Act) is maintained.

If the installation is relatively small, there may be little, if any, saving in labour. On the other hand, a single attendant can supervise the operation of a battery of mechanical stokers which incorporate coal and ash-handling equipment.

The maximum quantity of coal which can be hand-fired is about 6 tons per day. While this tonnage may compare unfavourably with the amount handled by a miner, the fireman generally has a number of other duties to perform, fire cleaning, and ash removal.

Smalls can be hand-fired with the thickness of fuel bed associated with hand-firing if means are adopted to supply primary air at the correct pressure and distribute it uniformly over the whole of the grate area. Distribution may be effected by the design of the grate and the manner in which the air is directed into the fuel bed. An illustration of this principle is found in the " Turbine " grate which, when hand-fired smalls are used, carries a fuel bed of 6 to 8 in. and functions well. This type of grate can also be used with a sprinkler coal feeder.

Draught

The use of smalls involves an increased resistance to the flow of primary air which is overcome by supplying it at a correspondingly higher pressure or suction. Mechanical stokers which burn smalls are frequently equipped with forced draught fans which aerate the fuel bed and the natural chimney draught is thereby relieved of the necessity of drawing primary air through the bed.

Those mechanical stokers not so equipped rely upon natural or induced draught in common with a hand-fired installation.

But before this question of induced draught is considered, the best use should be made of natural draught. The importance of tight brickwork is well understood but the reason is not always clearly appreciated. The deleterious effect of infiltrated air is frequently associated with the efficiency of heat transmission. This may well be the case in a furnace other than a shell boiler but is of very slight importance in a Lancashire boiler setting. The main disadvantage of air infiltration in the latter case is that it hinders draught and the accuracy of CO_2 and temperature readings taken at the boiler outlet. Air will not enter a fuel bed if it can infiltrate through brick work and this is important when additional draught may be required in the case of burning smalls.

Mechanical Draught

Mechanical draught is not to be regarded as an undesirable necessity but as a method of operating more efficiently or achieving an increased capacity from the particular plant. When the conditions are such that natural chimney draught is inadequate, installation of plant to produce draught mechanically is a good bargain because the electrical energy expended in fan power is always less than the value of the additional heat transferred.

If, then, mechanical draught is employed to do what a natural draught chimney cannot do, the question arises as to whether there is any limit to these advantages. The quantity of air to be drawn through the furnace is a function of the amount of combustible to be burnt and, in highly rated plants, the velocity of the air may be sufficiently high to blow particles of fuel or ash off the grate, resulting in loss of efficiency and causing a nuisance by emitting grit. When such is the case this trouble can usually be dealt with by some method, such as a change from a free burning coal to a slightly caking coal, adequate moistening of the fuel and altering the distribution of air flow. There remain the extreme cases which may be classified as heavily overloaded plant. Such installations are never efficient, whatever the circumstances, and their operation calls for the best coal in order that they can deliver the overload, however inefficiently.

It is generally in such cases of overloaded plant that an excessive amount of incombustible material in the smalls may cause trouble. It has been noted that the ash content of small coal is not necessarily any higher than that of large coal. When it is higher, more coal has to be burnt to compensate for the lower heating value, but this is allowed for in the price. It is when a plant is overloaded and there is no margin of capacity that this step may be difficult or impossible, but here again, the main factor is the incapacity of the plant.

The moistening of coal reduces the loss of fines, particles of coal or coke carried from the furnace in the gas stream.

When a slack containing a high percentage of fines is being burnt, the effect of moisture is to reduce the difference in resistance between the areas of fine and areas of large coal, thus producing an even burning rate and the elimination of blow-holes. The lower resistance also results in a more even distribution of air over the length of the active fuel bed and this, in turn, reduces the carryover of grits.

Provided the fan and motor are of adequate capacity to meet possible overload conditions, induced draught is just as satisfactory, and more so, than natural draught. Furthermore, it is never an economical proposition to employ the sensible heat of chimney gases for draught promotion when it can be used in heat-exchange equipment and replaced by an induced draught fan.

If, instead of using the heat for draught promotion, it is absorbed in extra heating surface, e.g. in an economizer, the saving for each 100° Fahrenheit reduction in the exit gas temperature is some 4 per cent of the gross calorific value of the fuel.

The paper continues by making brief references to those industrial requirements for which smalls are already in use, or for which they are generally unsuitable, namely, the ceramics industry, coke, pulverized fuel firing, metallurgical furnaces, railways and gas producers.

Clean Air Act

The matter of changing from large coal to the burning of smalls must also be related to the Clean Air Act.

Whatever points may be conceded in favour of hand-firing, it must be admitted that it is cyclic and, no matter how adept a fireman may be, it is impossible for him to arrange the admission of combustion air to suit fuel bed conditions which change at every moment.

It is the inefficient admission of air which causes smoke emission. The employment of mechanical firing for the combustion of smalls has the additional advantage that the cyclic element in hand-firing is eliminated. This is even more important when firing has to satisfy efficiently a widely fluctuating demand. Steam storage helps this.

Hand-firing of large coal today is out of date and it is doubtful whether the supply of good firemen is any longer equal to the demand.

Thus the dearth of first-class men capable of hand-firing in compliance with the requirements of the Act is another reason for changing from hand to machine firing of smalls.

But the choice of suitable mechanical-firing equipment is not a simple matter. Within limits, mainly the relationship between the rating of the plant and what may be termed the " more difficult " coals, certain types of mechanical stoker will ensure such combustion conditions as will satisfy the requirements of the Act.

In conclusion, the change from large coal to smalls should inevitably result in a cheaper supply of heat but it is not a simple matter to estimate the influence of this reduction upon general production costs.

Commercial Travellers and Diesel Fumes

Because so many of their members suffer from the smoke and fumes of diesel driven vehicles, the United Commercial Travellers' Association is taking a very active interest in the problem, and it recently convened an informal meeting to discuss the question. This was attended by representatives of a number of road-using, transport, and amenity organizations, including the N.S.C.A. The general opinion expressed was that there was no need for new regulations under the Road Traffic Act, but that the existing regulations should be better enforced.

NEWS

Testing of Domestic Solid Fuel Appliances

The N.C.B. and the Gas Council have accepted an invitation from the Ministry of Power to take over from the Ministry the responsibility for testing domestic solid fuel grates and stoves. A Domestic Solid Fuel Appliances Approval Council is being set up comprising representatives of the N.C.B., the Gas Council, the British Coking Industry Association, the British Ironfounders' Association and the Ministry of Power. Testing of appliances will be carried out in future at the gas industry's testing stations in London, Birmingham and Manchester; at the British Coking Industry testing station at Acton; and at authorized manufacturers works. The new council will make special arrangements for testing any appliances designed primarily for burning bituminous coal.

The names of approved appliances will continue to be published in the List of Domestic Solid Fuel Appliances, issued annually with quarterly amendments, by the Coal Utilization Council and the Solid Smokeless Fuels Federation.

An announcement will be made in the near future giving details of the arrangements made by the Council and the address to which manufacturers should apply for appliances to be tested. For the time being the present arrangements continue to apply.

A.P. and Honey

Sir Walter Furgusson Hannay, President of the Hertfordshire Bee Keepers Association, told the annual meeting that fumes from diesel-engined vehicles were polluting the honey in bee hives throughout the country. He urged all members to write to their M.P.'s and complain.—*Hertfordshire Mercury.*

The Clean Air Act in Wales

Mr. Henry Brooke, Minister of Housing and Local Government, and of Welsh Affairs, speaking at a Conservative conference at Newport, stated that out of thirty local authorities in Wales, only one had taken steps to create a smoke control area—Newport. He commented: "I am disappointed that Welsh local authorities are at the bottom of the list in the clean air movement."

"Clean Air Over Lambeth"

A novel feature of the Lambeth Clean Air Exhibition, February 19th-25th, was the excellent free information booklet "Clean Air Over Lambeth." Produced by the borough's Public Relations Department it gives a full *resume* of all the information required by a householder in a smoke control area.

The Exhibition was arranged to introduce the idea of clean air to the borough and in particular the 2,500 families living in the 100 acre smoke control area, due to come into operation in October. Exhibits were provided by the South Eastern Gas Board, the London Electricity Board, the National Industrial Fuel Efficiency Service and this Society.

A feature of the opening ceremony performed by the Mayor, was the presentation of four £10 awards to boiler operators who reached a very high standard in the City and Guilds Boiler Operators Certificate Examination. The awards were sponsored by the National Industrial Fuel Efficiency Service.

Paisley Enforces Smoke Control

Many of the 2,400 families who are tenants of Paisley's Foxbar housing scheme have ignored the condition in their missives of let (tenancy agreements) to burn only smokeless fuels. The town council is now asking the Secretary of State for Scotland to agree in principle to the declaration of the estate as a Smoke Controlled Area.

The Warwickshire Clean Air Council

This Council, consisting of local authorities in the County of Warwick, has recently issued its first annual report. The report shows that the Council is developing many interesting features. It has, for instance, secured for itself a relatively substantial income (relative, that is, to other advisory bodies), by means of which it is looking after and co-ordinating the measurement of air pollution in the county. This work is being carried out by the Council's Technical Advisory Committee, which is also rendering an important service by acting as a " Prior Approval Committee " for the consideration of any plans for new installations on which its constituent members seek assistance.

Publicity is also being given active consideration and application, and to assist in promoting public relations the Council has inaugurated an annual luncheon, the first of which was held recently in Coventry, with its chairman, Councillor R. Loosley, presiding. Mr. Marsh, Director of the N.S.C.A. had the privilege and pleasure of attending this function and of proposing a toast to the Council.

UNESCO and Smog

Courier, the international journal of UNESCO, devotes the greater part of its March 1959, issue to the problems of air pollution. Dr. P. J. Lawther writes an article on " Must we use our city air as a sewer? ", and there are also articles by A. J. Haagen Smit and E. M. Fournier d'Albe—the latter on " Smog in the Tropics." A note on the financial losses due to polluted air is unfortunately badly out of date in its reference to this country.

Black Smoke from Diesel Engines

The Southern Regional T.U.C. Advisory Committee recently considered the nuisance created by thick black smoke from diesel motor vehicles. It was stated that in many cases it resulted from bad maintenance or unauthorised interference with the correct fuel pump and governor settings. While the police had power to prosecute and some quite heavy fines had been imposed, the committee thought not enough was being done to combat the nuisance.

Leamington

A Clean Air Exhibition held in Leamington from March 3rd to 7th proved a success. At the opening ceremony the Mayor, Councillor F. Grundy, ably dealt with the objects of the Exhibition and spoke of the enthusiasm of the Leamington Health Committee and their officers to promote within their area smoke control areas, so that in addition to the fine streets, buildings and lovely gardens, an added attraction will be Clean Air at Royal Leamington Spa.

The Exhibition stands proved most attractive and during the week were visited by 1,500 people. Considerable interest was shown in the material shown on all the stands, while the efforts of the Warwickshire Clean Air Council in their presentation to the public of the evils of a polluted atmosphere was striking and worthy of commendation.—*G. W. F.*

Successful Clean Air Exhibition

Camberwell Council's recent Clean Air Exhibition was such a success that further exhibitions are to be held. They will be staged in different halls in the borough so that all districts get a chance to attend. At the first exhibition, held in Peckham, 1,000 visitors attended, and more than half of them asked for advice on clean air problems.

Nuclear Winds—A Clean Air Possibility?

Professor Gordon M. Fair of Harvard University giving the Chadwick Trust Lecture to the Royal Society of Health Congress at Harrogate, April 28th, said that winds from nuclear sources might be used to clear air pollution from industrial cities. This was, however, very much a thing of the future, and for the present we must control air pollution by limiting the discharge of pollutants into the atmosphere.

New Film Strip

An excellent new film strip in colour *The Public Health Inspector*, has been prepared by Camera Talks, Ltd., in consultation with the Association of Public Health Inspectors. We show two of the frames from the section dealing with air pollution. The strip may be obtained from the N.S.C.A., price £2.12s.6d., as can Camera Talks earlier black and white strip, *Air Pollution*.

Ten Trees for One Car

Dr. Chauncey D. Leake, Professor of Pharmacology at Ohio State University, told the 1959 National Conference on Air Pollution, Washington D.C., that extensive tree planting may save mankind from a disastrous warming of the earth due to air pollution. The increased carbon-dioxide that industrial man is loosing into the atmosphere is forming a blanket surrounding the earth which will inevitably capture more heat from the sun. This will result in a " gradual melting of the huge polar ice caps, and the gradual rise of the oceans, drowning still further our shore lines." Dr. Chauncey Leake believes that the extensive planting of trees—10 for every car and 100 for every truck—will help matters, for trees and other green plants absorb carbon dioxide and breathe out oxygen.—*Science News Letter*.

Railway Smoke Investigation

A full scale investigation into the problem of railway smoke in London is to be made by the Metropolitan boroughs through their Standing Joint Committee. The matter has been raised by St. Pancras who are worried about the emission of smoke, grit and dust by locomotives at the various depots within the borough.

INDUSTRY AND THE CLEAN AIR ACT

Concluding the discussion at the Institute of Fuel reported in our last issue (Spring, 1959, No. 109, page 217)

Prof. M. W. Thring, who was a member of the Clean Air Council, said he was speaking personally and not representing the Council's views. There was already a solution for all the problems so far raised in the discussion, if people were prepared to spend enough money. It was a question of cost—capital cost or cost of training or running costs such as the heavy pressure drop experienced when using wet cleaning methods. Even for the cupola there was a solution, but it was too expensive. Although it might be said at first sight that there was no need for more research into these problems, there was in fact a need for research not to solve them—not to solve problems previously insoluble—but to make the available solutions cheaper in one way or another. In the extreme case, they would like to make clean air economic, just as there was an economic fuel saving when changing from hand-firing to mechanical stoker. The object of the research was to make the solutions economic.

The hot blast cupola was the cupola of the future; it was better than a cold blast and was bound to save fuel. But for the high cost of installing it, it would be an answer to the problems. The same comment was true of trains. There was a solution to the smoke and grit problem with trains but there was a question of cost. In any case, the railways said they would have no steam trains in 15 years' time and therefore asked, " Why spend money on this matter in the meantime? "

There was, therefore, much room for research. One problem was that of the open-hearth furnace plume, which was not as bad as it looked; there was a horrible red plume coming out of the open-hearth furnace but the deposition per acre per month was not very severe because it was so fine that it travelled a long way and could not easily be measured. The obvious answer was to have one chimney 500 ft. high for a row of furnaces, which would take the emission still further away—here Professor Thring reminded the meeting that he was speaking unofficially and not giving an official answer to the problem. As oxygen lancing was introduced more and more, this plume problem would become more severe, and they had to find a method of removing it. He expressed a personal prejudice against wet washing methods. These had two disadvantages: there was much dirty water to handle and the gases were so cold when they came out of the chimney that one lost much of the natural buoyancy which helped to spread the material. A dry method for this removal must be found and one which would give the plume maker something for his money, such as extra preheat on the air supply. That was what they were trying to do.

At the moment the Clean Air Act was not concerned with SO_2, but one would come to that problem in time when the doctors announced that SO_2 was a killer. One had to look ahead and to see what to do about it, and research workers were trying to find a dry rather than a wet method, which would use a vast quantity of water.

Another interesting research was into the relationship between SO_2 and smoke. Did these tend to get together and were they worse together than separately? Work was being done on that.

It was clear that several new instruments were needed. There were instruments for all these measurements but at present they were expensive and the most important part of research in this connection was to find ways of measuring, recording and indicating these various properties more cheaply. They were trying to produce a smoke recorder cheap enough to install on chimneys without setting the manufacturer back hundreds of pounds.

The firing of bricks was another problem. Smoke could arise when it was necessary to have a reducing atmosphere in the furnace, and when the temperature was too low smoke could be seen coming out. An interesting problem was that of developing a way of burning this, at the same time getting some benefit from burning it.

Outside smokeless zones, could a domestic fire be developed which burnt ordinary bituminous coal with a considerable reduction in smoke?

There was also the question of mixing secondary air jets, which was relevant to metallurgical furnaces. It had been shown by various researches that the old story that one had to make smoke in heat treating metal in order to have the right properties of the metal was not true. Methods had to be found, therefore, to help the old furnaces to get rid of the smoke and to use smokeless fuel.

He agreed that the best answer to the hand-fired Lancashire boiler was to let it die, but while it was dying one should do what one could to improve it. If the secondary air admission over the bed could be made automatic and cheap in relation to the amount of air needed—the amount of volatile coming from the bed—this would be very useful.

These were some of the research problems on which work was worth while, all with the aim of enabling people to meet the conditions of the Act without it costing them too much.

Dr. A. Parker said he had listened to the discussion with great interest. Mr. Hopthrow did not seem to have any major difficulties industrially. Mr. Machen had perhaps been a little hard on the hand-fired boiler, which, he agreed, had suffered from retarded development. He had rarely seen a hand-fired boiler properly designed to give reasonable control of the admission of primary and secondary air, and without such control there would be smoke—hence the introduction of smoke eliminator doors, which would not have been necessary had the boilers been properly designed in the first place.

He agreed that most hand-fired boilers should be replaced by mechanical stokers, at least for coal—not always for coke—but there were conditions in small works where a hand-fired boiler, with a properly trained and intelligent fireman, could meet what was required better than could many of the mechanical stokers. This was not so much the case with large installations, but there were cases with fluctuating loads where an intelligent fireman could adjust conditions to meet changing qualities and sizes of coal.

Mr. MacDonald had said that it was important to have the right coal for the type of stoker; it was necessary to have the right size and consistent quality. That was not easily achieved nowadays, especially when the National Coal Board had millions of tons—and an increasing quantity—of very small coal, of high ash content, which could not easily be sold and which must be used somehow.

Although he agreed with Mr. Redman he would not go all the way with him. Banked fires were a problem which might need auxiliary firing by other fuels when starting up from cold, although the Clean Air Act gave starting from cold as a defence. What was " cold "? How cold? That had yet to be decided.

One of Mr. Marshall's difficulties was that there were so many small cupolas. The industry had grown up from very small undertakings. Dr. Parker was not very keen on wet washers, because if they were not efficient and some dust went out with the water vapour, or a water spray, the particles settled on nearby materials, including iron and steel. If the gases still contained sulphur—which they would—then corrosion could be accelerated. In one case where a wet washer had been installed on a small power station, there had been increased corrosion on a nearby gas holder.

Not enough had been said in the discussion about the difficulties facing the industry of removing grit and dust. The Act said that if one burnt more than 1 ton of solid fuel per hour of any kind or any quantity of pulverised fuel—even 1 lb. an hour—one must have a grit arrester. With smaller plant that would be a very expensive item. Many manufacturers would weigh up the position—the cost of the plant, the cost of the coal, the labour involved, the output of their products, which might be very valuable products—and might decide to switch to one of the refined fuels, oil, gas or electricity. This part of the Act would, therefore, accelerate the change-over in many cases when all the costs of production had been worked out.

No reference had been made to chimney height. That would be a problem, because the formulae alone would not solve the problem for all local circumstances. They would work only if there were no adjacent buildings at different heights and no valleys and hills. The problem could be dealt with only by experts who knew how to use the formulae and to apply common sense and experience.

Dr. R. Lessing referred to the problem of arresting grit and dust. In his Presidential Address to the National Society for Clean Air recently he had spoken of the helpful attitude of industry towards the implementation of the Act, and he had had in mind the fuel-using industry. However, another party was involved—the manufacturers of plant for dealing with the effluent before it reached the chimney. As Mr. Hopthrow had said, the position here was not altogether satisfactory. A great many of these plants had to be installed, whilst the principles on which they should be designed were by no means clearly established, particularly with the smaller and medium-sized plants. He had had the honour of serving from the beginning on the Committee set up in the early 1930s by the British Standards Institution which prepared a specification (B.S. 893:1940) for testing the efficiency of dust extraction plant and the emission of solids from chimneys of electric power stations.

The difficulty then was to find testing equipment and test methods which would be readily applicable throughout the life of the plant to the daily, weekly or monthly checking of its performance. Whilst take-over tests of the equipment might give 100 per cent. of the contract performance, that efficiency would not be maintained for long in normal running. Even when the highest standard is reached which could be achieved today, it must be remembered that a power station with an electrostatic precipitator working at 97½ per cent. efficiency or even more would still emit 10 tons of flue-dust a day.

Coal supply was a subject on which he had often spoken. He would not refer to coal cleaning, because they all knew about that, but in view of the provisions of the Act, de-dusting of coal was very important. In the annual coal output there was about 10 million tons of natural coal dust; with the small coal being produced today that figure might be much higher. Although tests had never been made on a large scale to prove the point—perhaps those responsible had not wished to be faced with some unpleasant results—he (Dr. Lessing) was convinced that not less than 50 per cent of this dust naturally present in the coal was going out unburnt, or partially burnt, or as ash from completely burnt particles. It was here that the industrial user and those concerned with the provision of the equipment for removing dust must press their demands upon the coal supplier.

Dr. J. S. Carter said he was sorry that Mr. Damon, his predecessor as Chief Alkali Inspector, was not present because he was the Minister's general adviser on smoke emission and related matters and was also the Department's conference expert. Everyone needed a conference expert these days, and Mr. Damon had left the previous day for Norway where there was a conference on clean air. How the Norwegians managed to dirty their air Dr. Carter did not know, but they had as much right to hold a conference as anyone else.

He had been pleased that so many of the problems discussed by the meeting had not been his. So many difficulties had been scheduled under the Alkali Act that one of the few pleasures now left to him was to make long train journeys looking at the chimneys which were not his!

He would not refer to the scheduled processes because he had made an arrangement that neither he nor his staff would speak on this subject in public until at least twelve months had elapsed, which should save much misunderstanding—not entirely on one side.

The 1st June, 1958, did not inaugurate a millenium. Much useful and solid work had been done by his predecessor and others, and much steady and useful work had already been done in many of the big cities before the smog disaster a few years ago gave smoke abatement a sex appeal. He paid unreserved tribute to those who had studied the problem and done so much to pave the way for the present conditions.

Works would get fewer and bigger everywhere through the years and, with the concentration of industry, slips would be an increasing problem. It would be necessary to have electrostatic precipitators or other dust arresters working at fantastic efficiencies if enormous amounts of material were not to be admitted to the air. SO_2 seemed to be nobody's problem at the moment, but high chimneys must be introduced—and the high chimney was not a palliative or a second-best but was a method of bringing about adequate dispersal of treated gases. The combination of good combustion, first-rate dedusting and a high chimney had done more to improve conditions in this country than was generally realized.

Mechanical stokers were not always the answer. They were the answer with straightforward boilers, but in some intermittent ceramic kilns which were hand-fired there were 14 or 15 firing ports around the periphery and it was essential to get hot gases uniformly over the flash wall or bag walls in order to get through the mass of wet clay. With 14 ports one might be able to afford only four automatic stokers. The problem was to get the heat distributed uniformly. The number of rejects was said to be rising, and that must be watched carefully.

Incineration was not always an easy problem; some of the difficulties had been put under the Alkali Act. One person had asked him to help design an incinerator which would burn nitro-cellulose and nitro-cotton—he (Dr. Carter) had tried his hand but had rejected his design in the belief that the first week's operation would have seen the first British sputnik in orbit.

R. J. Bressey, speaking as an " oil man," said that in general users of oil fuel did not have much difficulty in complying with the various requirements of the Act. They certainly ought not to have difficulty, because compliance was quite easy provided good advice had been taken on the original choice of oil-firing equipment and the equipment was properly installed, maintained and operated. A number of industrialists were turning to oil as means of overcoming their clean air problems with other fuels; hand-fired boilers were one example.

Mr. MacDonald had said that with many of the difficult coals it was very important to be able to keep a consistent and even rate of firing. In many works that presented a serious problem so why not, where there was a battery of boilers, carry the constant part of the steam load on coal and have an automatic oil-fired boiler to take care of the variations? This was already working well in a number of cases.

He did not claim that oil was perfect. In war, oil had been used deliberately to make a lot of smoke to good effect! But in peacetime, and for a long time, the oil industry had tried to set a high standard of combustion efficiency. For their own work they did not use the Ringelmann scale but the Shell smoke scale which left off just below Ringelmann No. 2. No. 9 on the Shell smoke meter would be regarded as very bad performance for oil and No. 5 as reasonably good.

There were technical difficulties of another kind, concerned with the Act rather than combustion, and he would take the opportunity to refer to two of them. The first was the widespread misunderstanding about the position of oil in smoke control areas set up under Section 11. It was surprising how many people still believed that in such areas they could use only what the Act described as an " authorized " fuel. The word " authorized " seemed to have acquired almost magical significance, and it was apt to convey the wrong impression to the lay mind. The fact was that oil was also an accepted fuel for use in smoke control areas by virtue of the Smoke Control Areas (Exempted Fireplaces) Order, 1957, which laid down that fireplaces specially designed or adapted for liquid fuel, provided they were so installed, maintained and operated as to minimize the emission of smoke, should be exempted from the provisions of Section 11 of the Act. It was important to note that this automatically brought oil within the ambit of the Ministry's model bye-law on smoke prevention (No. 106A).

The second difficulty—already mentioned by Dr. Parker—concerned the height of chimneys. They all knew what Section 10 of the Act said, but he wanted to question whether it was desirable for this subject to be left purely as a preserve for the experts. At the same time, how was the average local authority to deal with this part of their duties under the Act? The Ministry had kindly provided them with a Memorandum on Miscellaneous Provisions of the Act and, if they referred to this, paragraph 16 told them that they would find guidance about the technical considerations governing the heights of chimneys in the memorandum printed as Appendix VI to the Beaver Report. On turning to that appendix, what did they find? An admirable little paper, not on chimney heights, but on " The Influence of Chimney Design and Height on the Dispersion of Flue Gases from Industrial Chimneys." This gives much interesting information, including formulae bearing on chimney height and the dispersal of smoke and gases—but, Mr. Bressey asked, what is the *average* local authority to do with it? He was not thinking of such large authorities as Manchester, Liverpool, Birmingham, etc., but of the multitude of smaller authorities who have no great technical expertise at their disposal.

He suggested that these authorities had been put in a most invidious position and that the matter ought not to be left in this state. He knew it was not an easy subject but wasn't it time the Ministry, the Institute, the B.S.I. or some other authoritative body tackled it and provided some really practical guidance?

The other difficulty which sometimes arose in connection with chimneys was the conflict of interest and views between different Departments of the same Authority; for example, the Public Health side said you *must* have a 120-ft. chimney for a certain building and the Architects and Planners then said " not on your life! " This was an amusing little game—sometimes played with the assistance of a Ministry or two—but it was rather frustrating for the man at the receiving end, the fuel user, and even this game might be made more difficult to start and play if there was some generally accepted and practical guidance available for all concerned.

(*With acknowledgements to the Journal of the Institute of Fuel, February*, 1959.)

Correction.—We are asked by Mr. C. Machen, whose contribution to this meeting was included in our last issue, that his reference to the Chief Public Health Inspector, Birmingham (p. 219), should have been to the Chief Smoke Inspector.

AIR POLLUTION ABSTRACTS

330. The Measurement of Smoke from Industrial Boilers. Hurley, T. F. (Sanitarian **67**, 109–123, Discussion, 123–127, 157–158, November 1958.) Two problems are discussed: (1) the extent to which observations correctly made by the recognized methods give a true measure of atmospheric pollution; and (2) variations that can occur in the readings obtained when the same smoke is measured by different observers and under different conditions. (B.C.U.R.A.)

331. Sulphur. Soc. pour l'Equipement des Ind. Chimiques, S.P.E.I.C.H. I.M. (Brit. Pat. Spec. 802 384. Appl. date (France) 18th May, 1955.) Sulphur is separated from suspension in aqueous solutions, *e.g.*, obtained by extraction of flue gases, by adding a water-insoluble auxiliary liquid of density greater than that of the aqueous medium and separating the liquids by centrifuging. (Pat. Abstr. J., 1958 (1st and 8th October), 22) (B.C.U.R.A.)

332. Fuel and Power in British Industries. Thompson, F. C. (Nature, 1958 (20th December), 182, 1713–5.) Summaries are given of the following papers presented at the Symposium organized by the Manchester Joint Research Council and held on the 5th–7th November, 1958: (1) The economic aspects of oil, by P. H. Frankel; (2) The uses of oil, by W. S. Ault and H. Cunliffe; (3) Britain's resources of coal, by A. M. Wandless; (4) Coal utilization, by D. Hicks; (5) Gas, by Sir Harold Smith; (6) Nuclear power, by P. T. Fletcher; (7) The use of electricity for heating, by T. E. Daniel and A. O. Johnson; and (8) The utilization of fuel in (*a*) the chemical industry (G. A. J. Begg), (*b*) the metallurgical industries (T. P. Colclough), and (*c*) general industry (W. A. Macfarlane). (B.C.U.R.A.)

333. South Kensington District Heating Scheme. Anon. (Heating, 1958 (April), **20**, 109–115; (May), 145–149.) A description is given of the high-pressure hot-water central boiler plant, the system of distribution mains, and the arrangements for distributing the heat in the buildings themselves. (B.C.U.R.A.)

334. Smoke-consuming Domestic Stoves. Thring, M. W. (Brit. Pat. Spec. 803 528. Appl. date 25th November 1955.) Construction for a smoke-consuming domestic stove capable of burning bituminous coal and usable as an " open " fire. (Pat. Abstr. J., 1958 (29th October and 5th November), 9.) (B.C.U.R.A.)

335. Atmospheric Diffusion of Air Pollutants. Analog Computer Study. Karplus, W. J., Bekey, G. A. and Pekrul, P. J. (Industr. Engng. Chem., 1958 (November), **50**, 1657–1660.) An approximate mathematical model was formulated for the physical and chemical processes involved in two-dimensional atmospheric diffusion, and was programmed on an electronic analogue computer. Results indicate that computers are potentially valuable for studying chemical reactions in the atmosphere. (B.C.U.R.A.)

336. The Correlation of Optical Density with the Concentration and Composition of the Smoke Emitted from a Lancashire Boiler. Hurley, T. F. and Bailey, D. L. R. (J. Inst. Fuel, 1958 (December), **31**, 534–540). Tests on a hand-fired Lancashire boiler show that the opacity of smoke, expressed in terms of either its optical density or its Ringelmann number can be correlated with the concentration of suspended matter in the flue gases and with their analysis. The relations vary with load, and the concentration corresponding to any given optical density is higher at half load than at full load. (Authors' abstract.)

337. Polycyclic Hydrocarbons in Rural and Urban Air. Commins, B. T. (Int. J. Air Poll., **1,** 14–17, Oct. 1958). This report deals with the determination of polycyclic hydrocarbons in the smoke collected during the winter of 1956–57 from rural and urban atmospheres in Great Britain. The analyses were done as part of the British Empire Cancer Campaign's Cancer Survey (Stocks, 1958). The smoke samples were collected on filter papers in urban and rural districts of North Wales, Cheshire and Lancashire, and the weight of smoke on the filters assessed by reflectance measurements. The smoke papers were extracted in acetone; the extract was reduced carefully to dryness and redissolved in *cyclo*hexane. The hydrocarbons in this extract were then chromatographically separated on a column of activated alumina and the amounts of each hydrocarbon determined in bulk eluates by ultra-violet spectrophotometry. The amounts of pyrene, fluoranthene, 3:4-benzpyrene and 1:12-benzperylene were determined at each of the 23 sites sampled and the results expressed as parts of hydrocarbon per 100,000 parts of smoke and μg of hydrocarbon/m^3 air. The results showed that the concentration of hydrocarbons was much lower in rural than in urban areas. The errors in measurement of the hydrocarbons are discussed.

338. The Effect of Pollution on Radiation in the Atmosphere. Sheppard, P. A. (Int. J. Air Poll. **1,** 31–43, October 1958). Absorption and scattering by a polluted atmosphere are considered in relation to:

(*a*) Solar radiation (wavelengths 0·3–3μ)
(*b*) Terrestrial radiation (wavelengths 3–60μ)

Scattering and absorption by particulates are considered in the light of Mie theory, in regard both to the polar diagram of scattered light and to the extinction cross-section as a function of wavelength, particle diameter and refractive index. Single scattering is mainly forward but multiple scattering, which is significant for transmissions less than about 0·75—transmission of solar radiation by a heavily polluted column may often be less than this limit—results in a greater fraction of backward scatter.

Some observations of Waldram on polar diagrams of scatter and on transmission over the bottom kilometre of a polluted atmosphere are quoted to show that more than 30 per cent. of the solar beam may be scattered and more than 25 per cent. absorbed by the column. Of the 30 per cent. or more scattered probably less than half would be lost to the atmosphere by upward scatter.

Observations of solar radiation, direct and diffuse, in central London and on its periphery, provide further values of scatter and absorption which point in the same direction as do those of Waldram. Terrestrial radiation appears to suffer significant absorption by particulates even in a rural atmosphere and it is much stronger in London. The effect is to increase the cooling rate of the bottom kilometre or so of the polluted atmosphere by as much perhaps as 2°C. or 3°C. per day. The ground surface must then cool somewhat less by terrestrial radiation. Computations by Möller on a model atmosphere containing a given distribution and amount of particulate matter are broadly in line with this conclusion.

Thus there is significant upward scatter of solar radiation by pollution—a loss of heat to the atmosphere—and a significant absorption, which replaces a corresponding absorption at the ground. The absorption of solar radiation is offset by increased emission of terrestrial radiation by the layer concerned, and the latter loss will be dominant in mid-winter conditions when solar energy is necessarily small.

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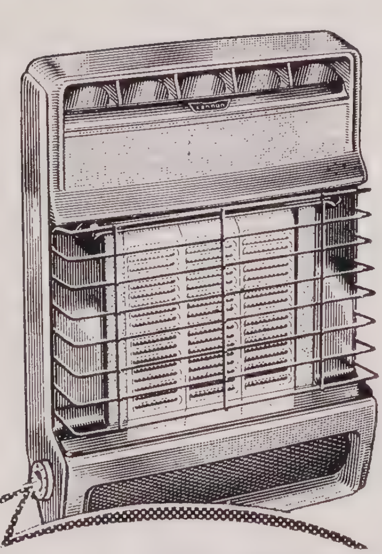

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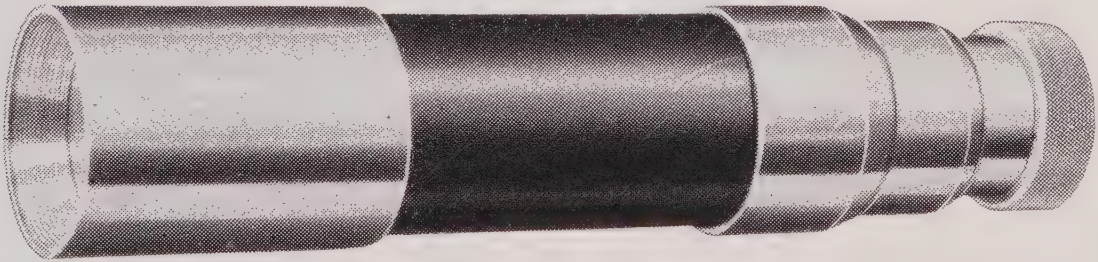

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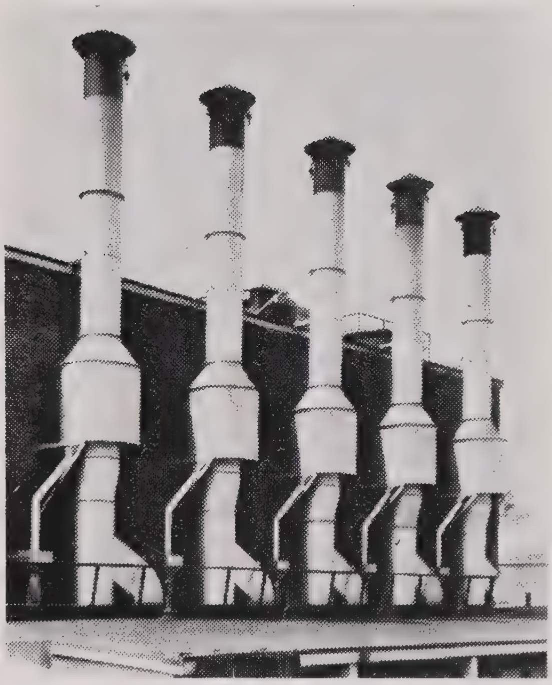

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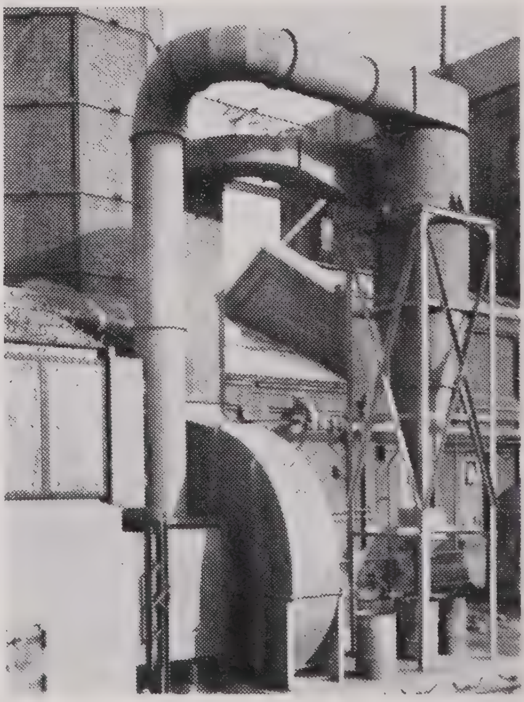

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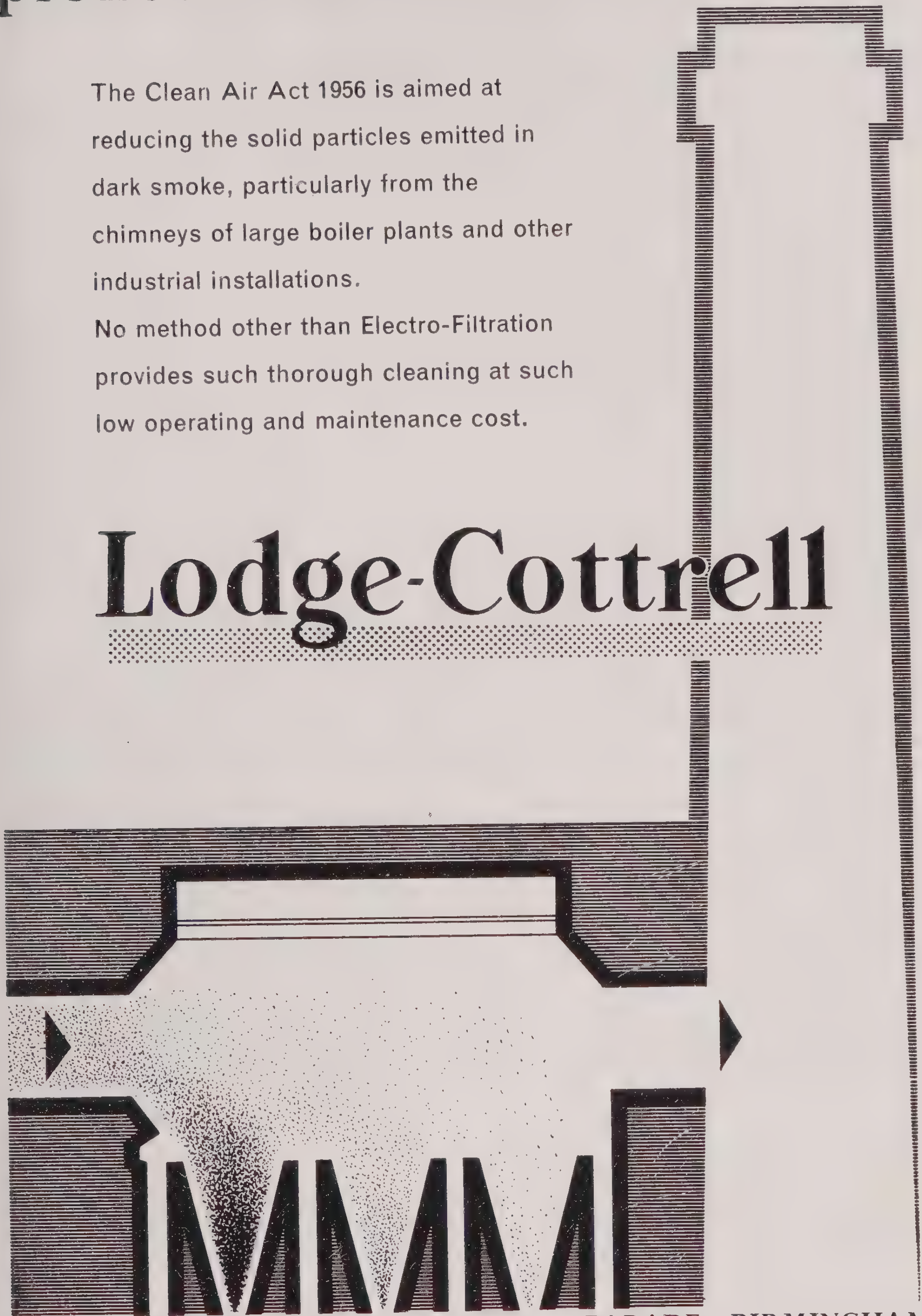

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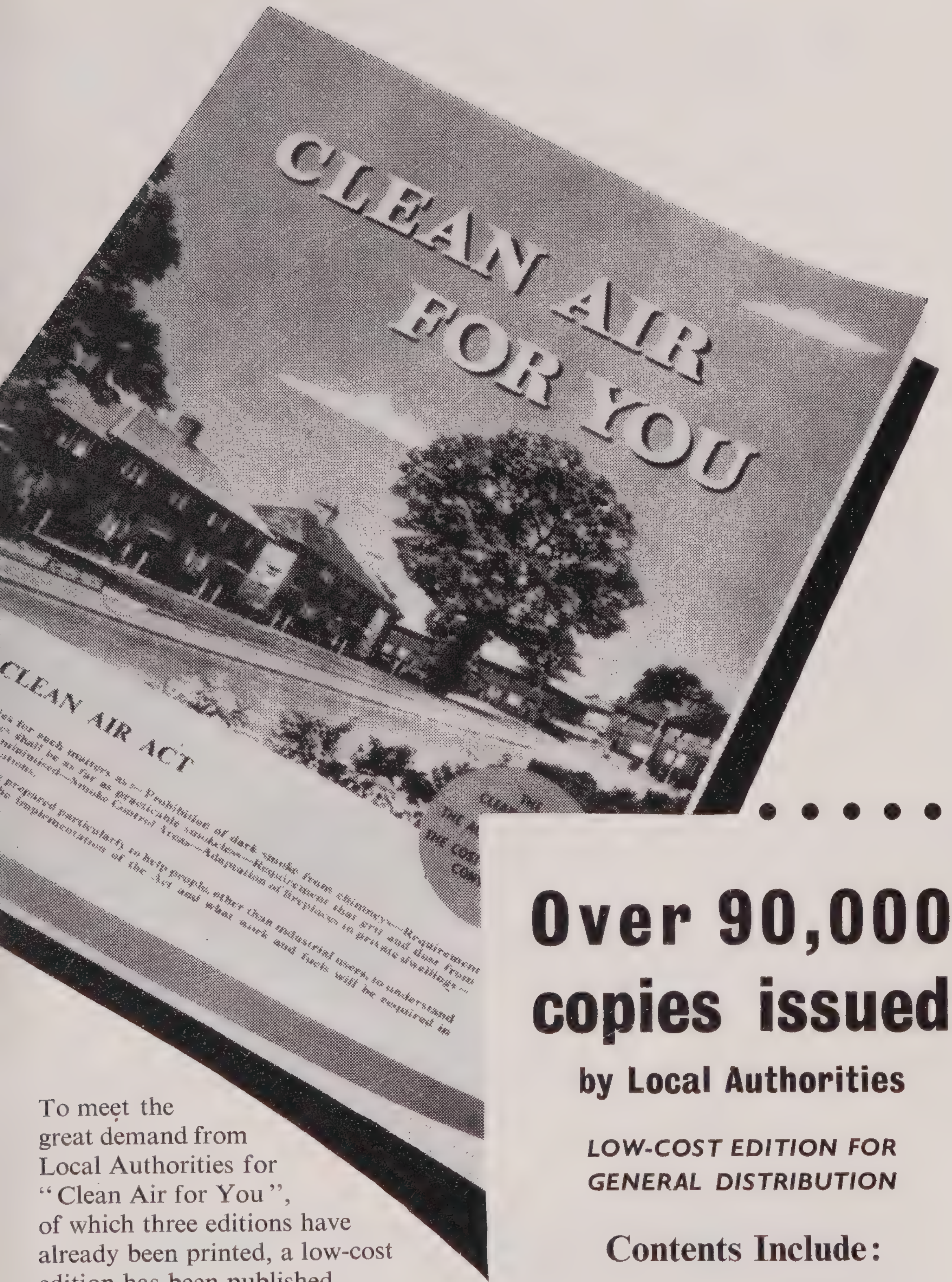

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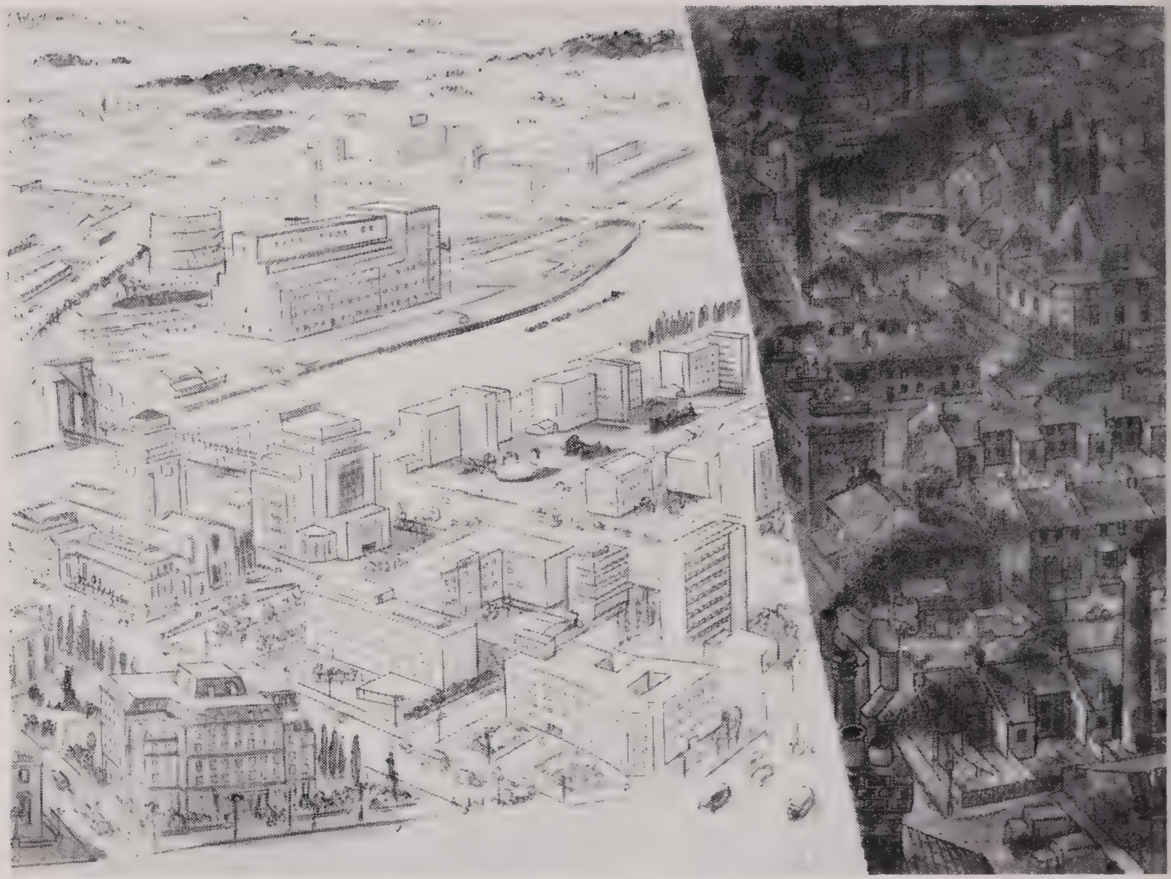

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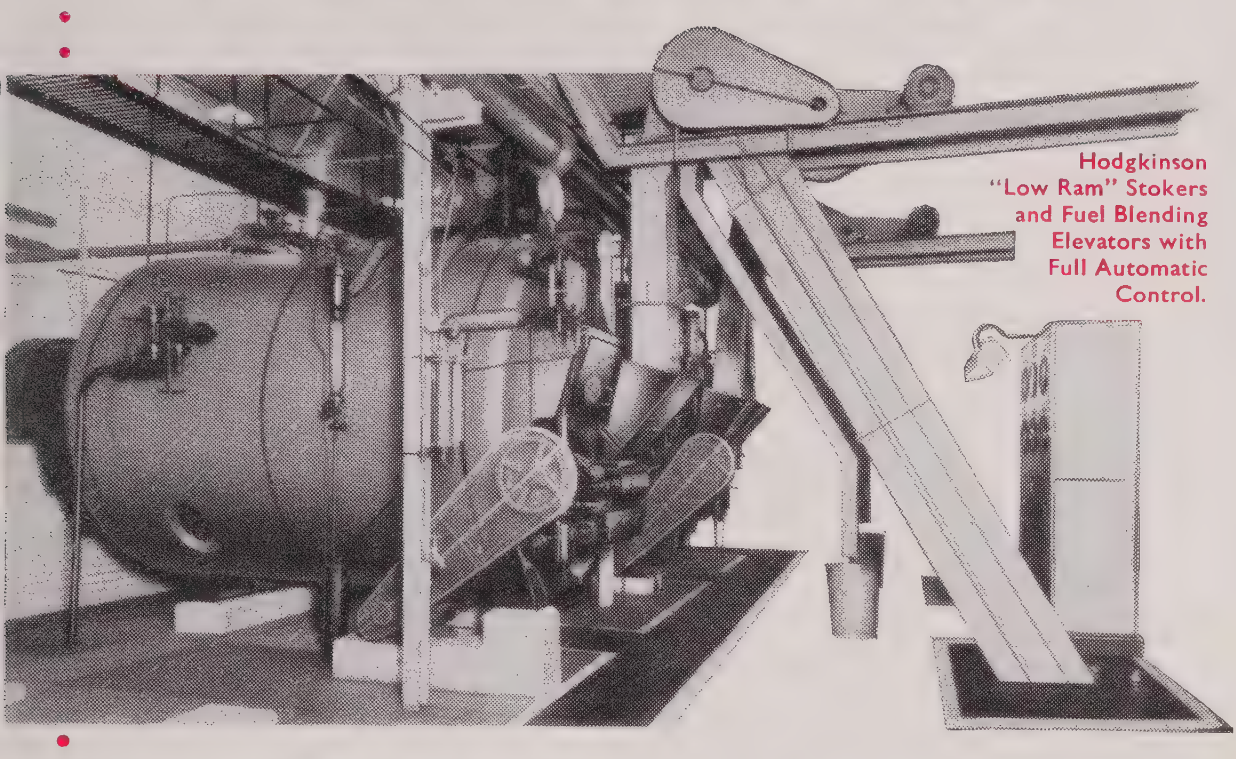

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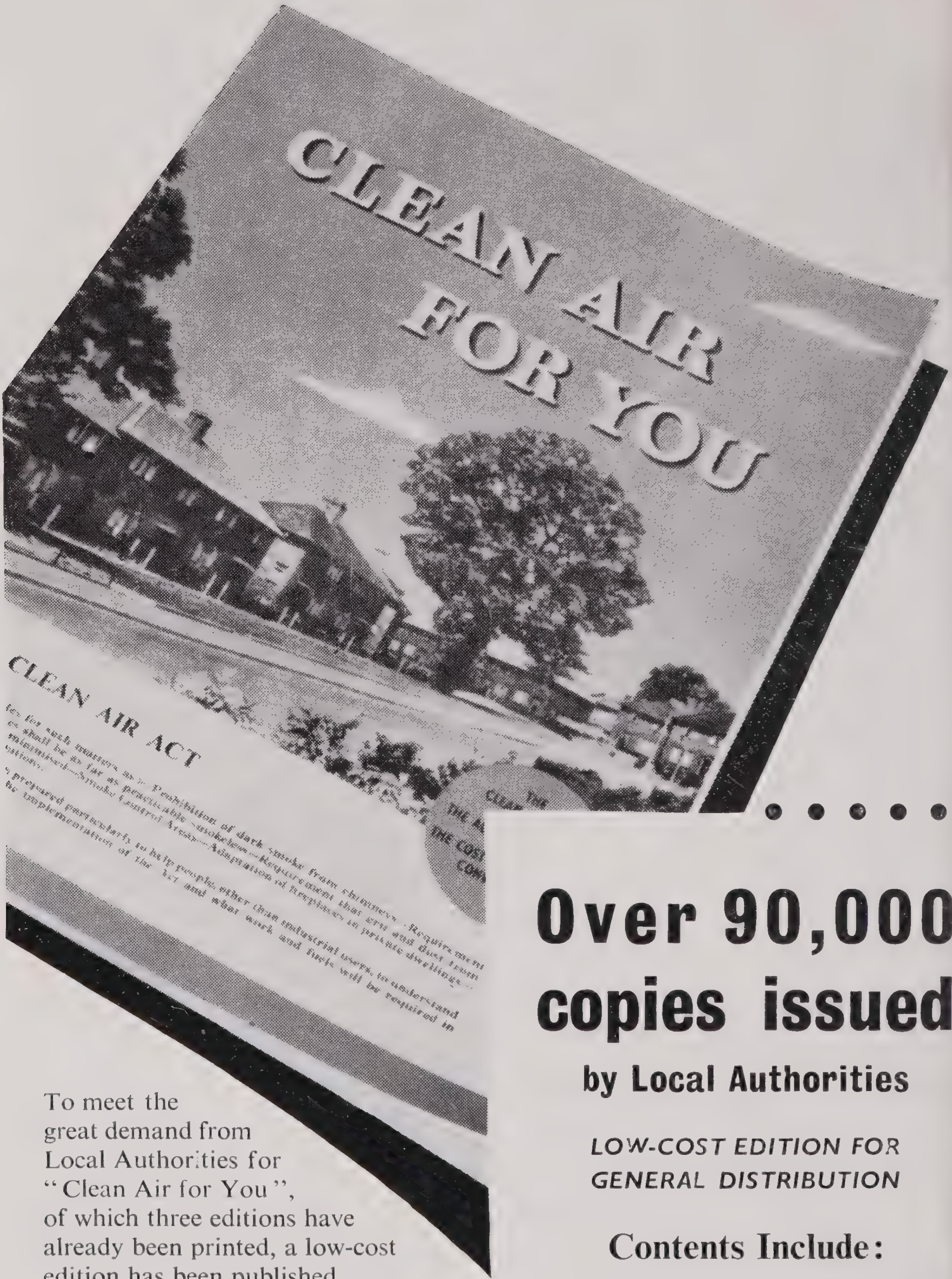

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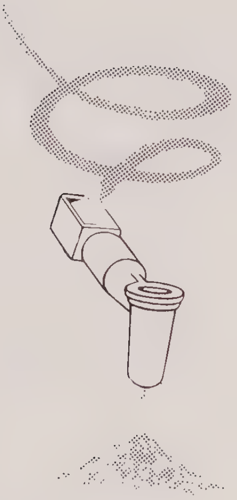

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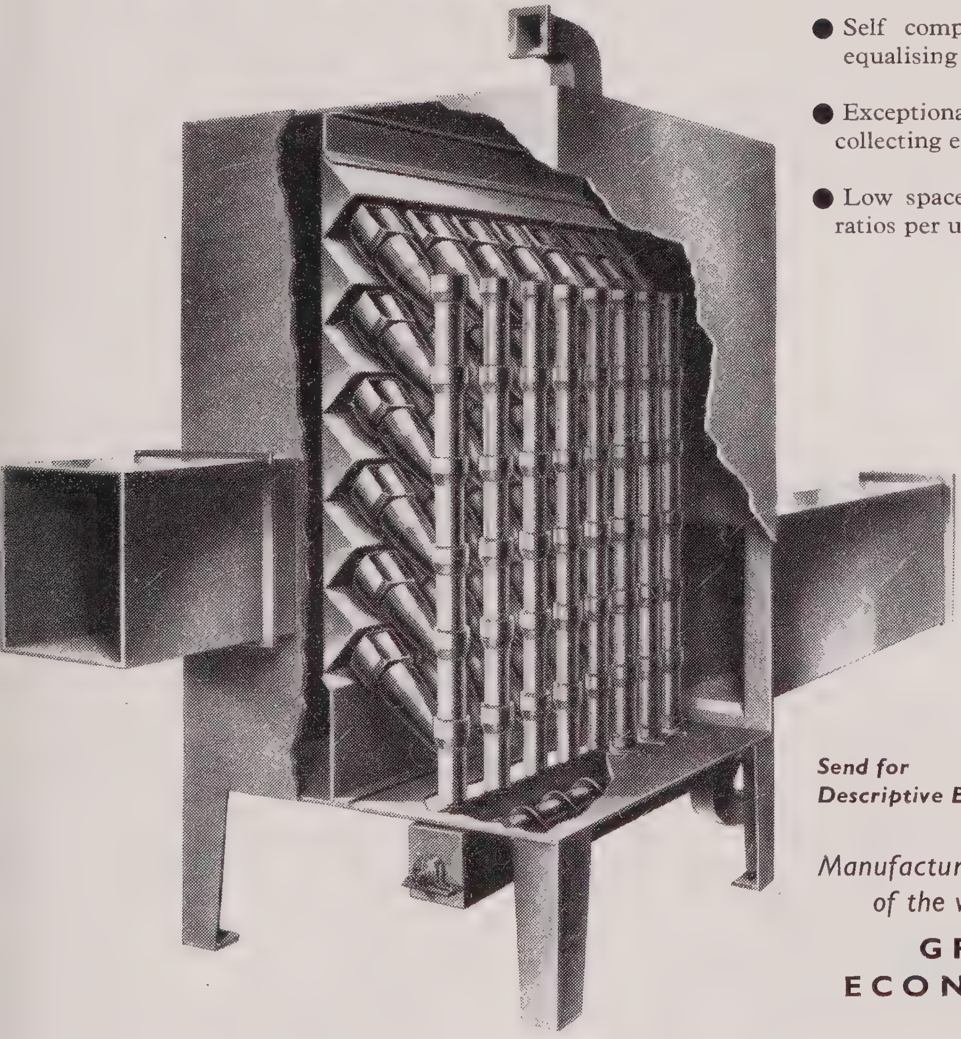

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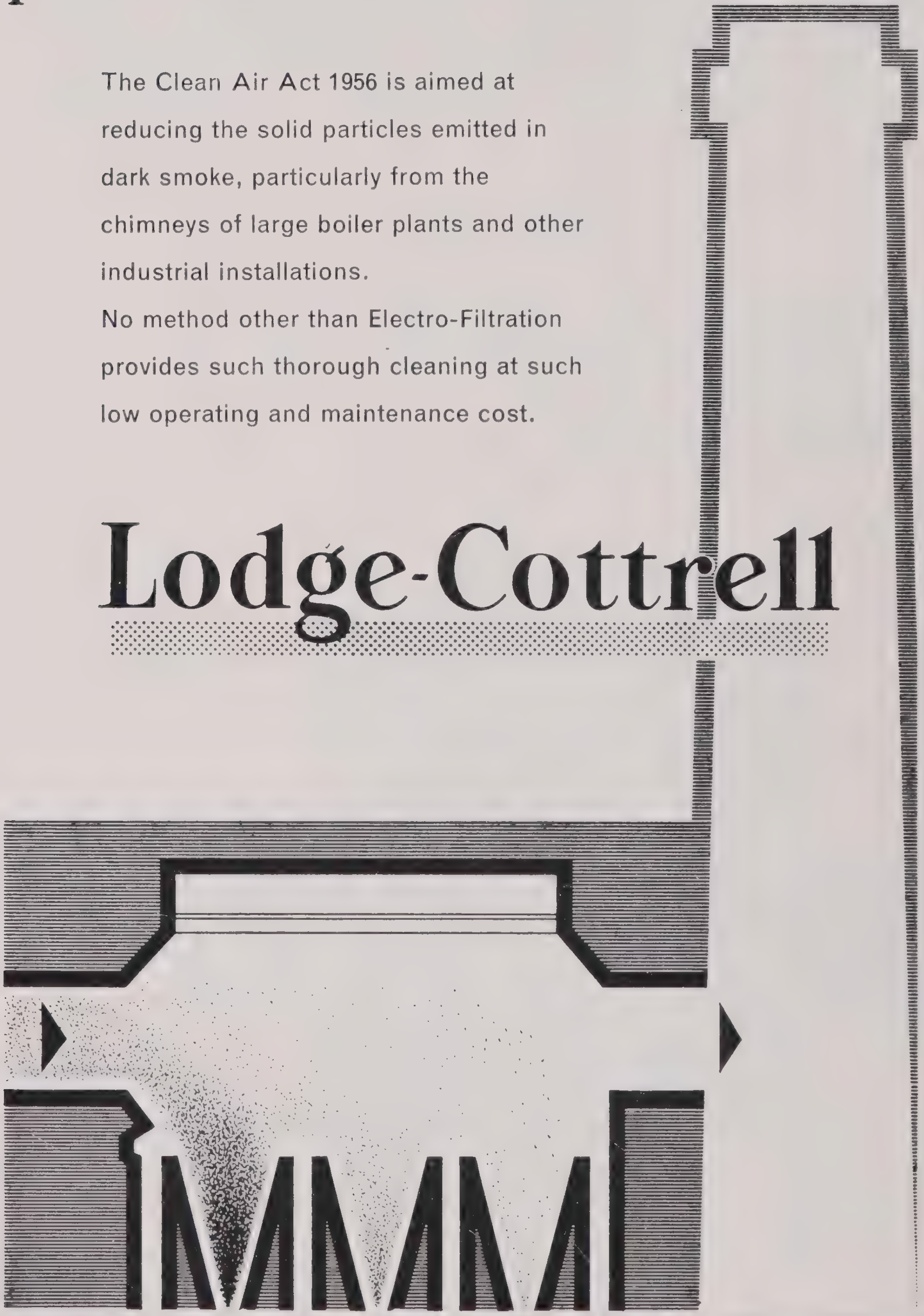

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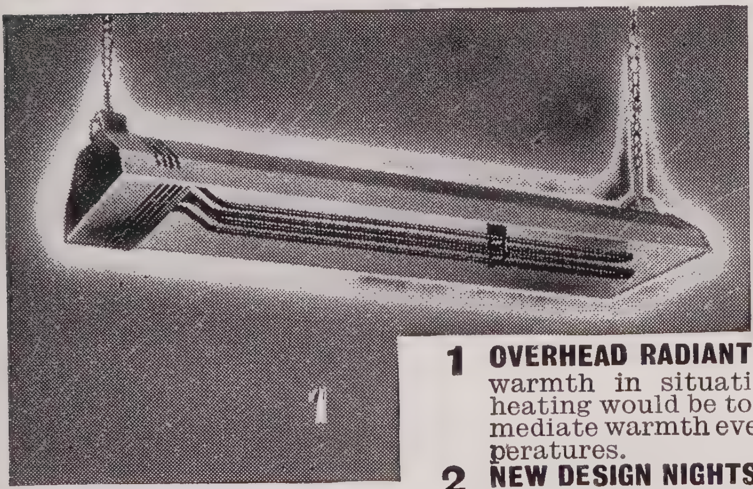

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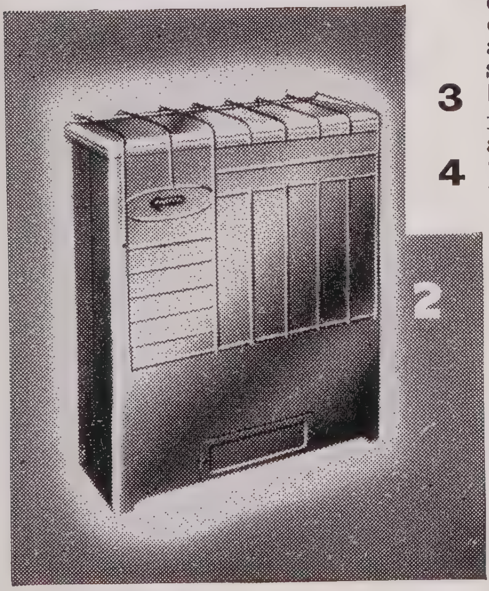

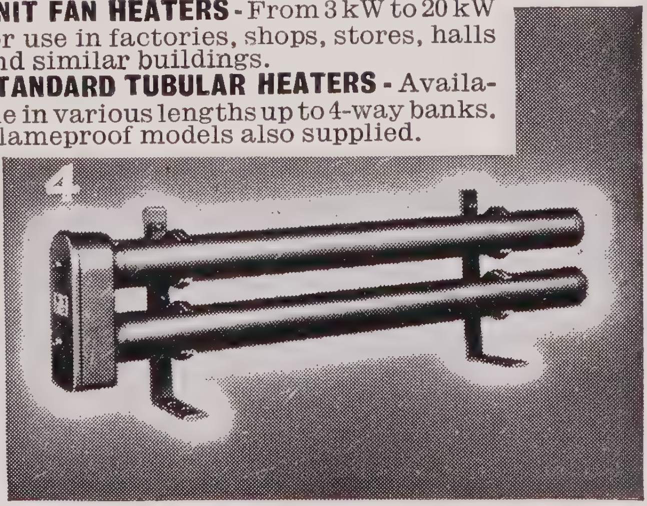

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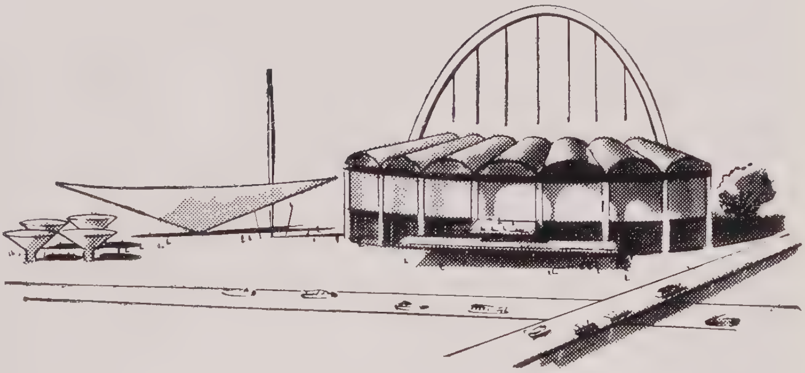

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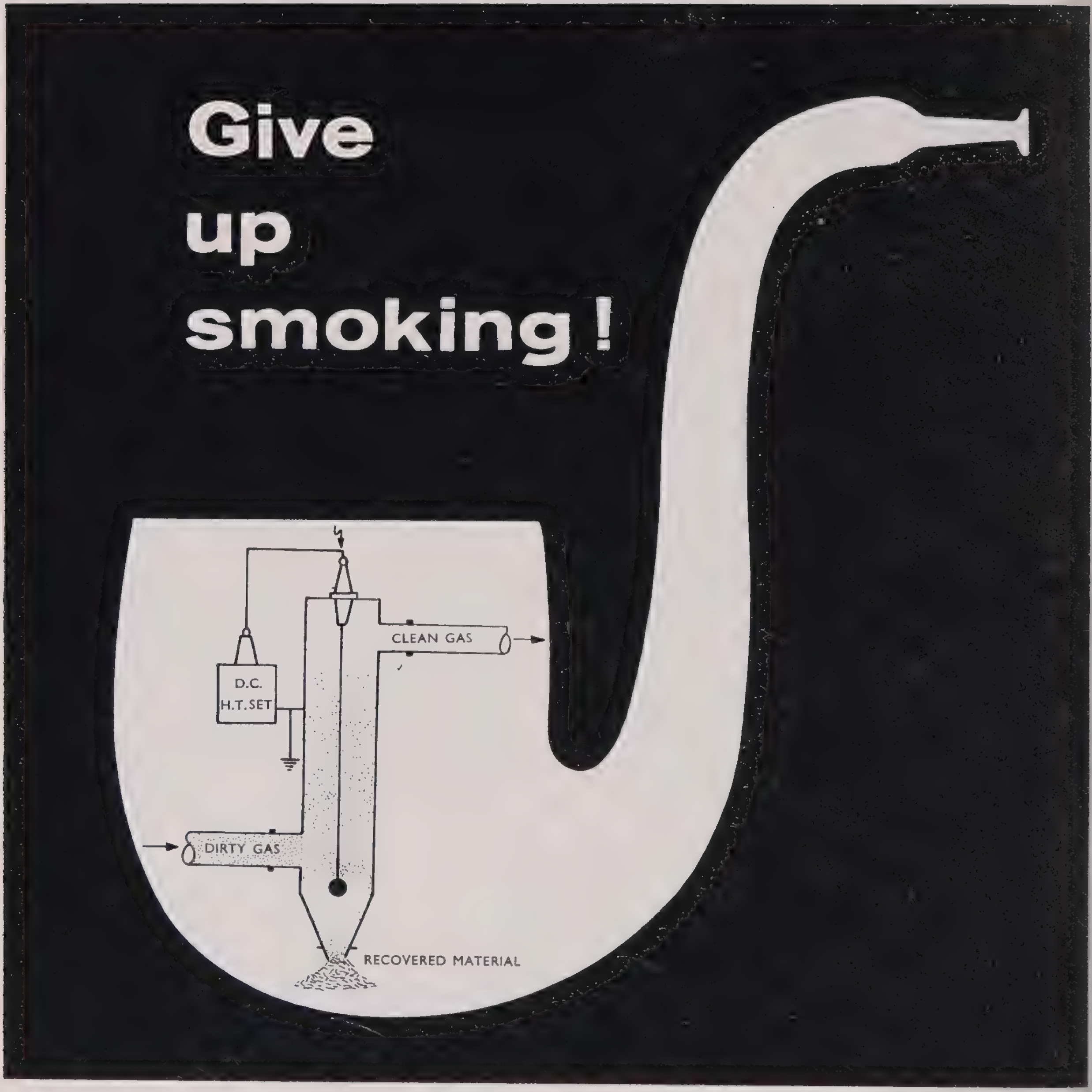

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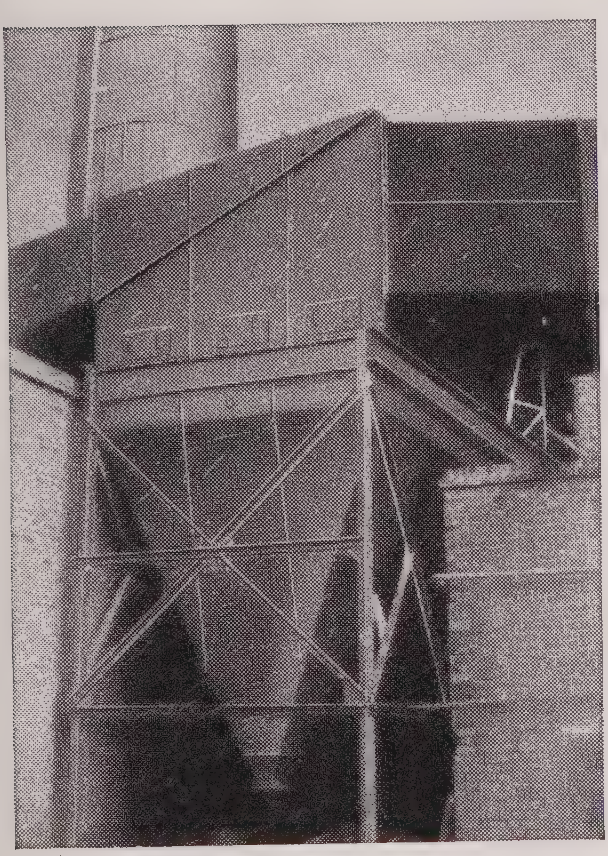

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SMOKELESS AIR

Vol. XXX No. 111 Autumn 1959

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SMOKELESS AIR is the official organ of the Society, but the views expressed in contributed articles are not necessarily endorsed by the Society. Abstraction and quotation of matter are permitted, except where stated, provided that due acknowledgments, including the name and address of the Society, are made.

Ships, towers, domes, theatres and temples lie
Open unto the fields, and to the sky ;
All bright and glittering in the smokeless air.

SMOKELESS AIR

The Conference

WAS the Society taking too much of a risk when it decided to hold a Diamond Jubilee Conference and to call it " International "? Would there be enough international support to justify the word? We once had doubts, but they have been completely dispelled by the truly world-wide character the conference has assumed. There is a record number of delegates coming from this country—nearly 1,000 at the time of writing—but, more surprisingly, the number from overseas has risen to about 160, four or five times our original estimate. They represent nearly thirty countries and every continent.

Delegates have already been informed, and we are pleased to be able to announce more widely, that the Conference and Exhibition will be opened on the morning of 20th October, at the Seymour Hall, W.1, by the Rt. Hon. the Lord Mayor of London, Sir Harold Gillett.

In addition to the principal general reception at Guildhall, there will be special small receptions for overseas guests at Lancaster House and County Hall, and a full programme of some twenty visits (alternative choices, of course) has been arranged for the final day. The most important part of the conference is the sessions at which the many papers submitted will be discussed. As with the numbers attending, the open invitation to submit short written contributions has met with a much bigger response than was anticipated, and the volume of " preprints," now at the press, will contain 69 papers, of which 49 have come from overseas.

This has led to some revision of the original programme, and the papers will be discussed at the four sessions, Tuesday afternoon to Thursday morning, under the following heads: National air pollution problems, legislation, education, etc.; technical processes and methods; the investigation, observation and measurement of pollution; research (including medical), and international co-operation. The final session, on Thursday afternoon, will consist of a review of the four sessions by their respective chairmen, a final general discussion, and a summing-up and closure by the President, Sir Hugh Beaver, who will be in the chair on that occasion.

The arrangements mean that an average of 17 papers will be discussed at each of the four sessions, and obviously this means that—regretfully—it will not be possible for authors to read their papers (which will have been distributed in advance), nor in many cases even to introduce them. It is, however, hoped that all the discussion will be terse and to the point, so that every author who wishes may have an opportunity of replying at the end of the session.

The reading, editing, in some cases translating, duplicating, and printing of the influx of papers has been a major task for the Society's office staff. Many of the papers are illustrated (as the showing of slides will not be practicable) and well over a hundred photographs, diagrams and graphs will be included in the printed volume.

Without in any sense trying to make a premature judgment on the success of the conference as a whole, it can be said that the material to be discussed will make it the most comprehensive international symposium on air pollution ever held. Many of the papers are of considerable intrinsic importance, considered apart from anything else, and others have an importance and interest in showing what is being done, or attempted, thus helping to complete a picture that depicts a new—and rather startling—world-wide concern about air pollution. The conference, in the form in which it has grown, could not have happened a decade ago.

Mechanical Stokers Exemption

On another page details are given of the new order made under the Clean Air Act, by which furnaces fired by mechanical stokers are automatically exempted from control in smoke control areas, provided that they minimize smoke. The order seems to have aroused considerable criticism and not a little scepticism. The latter is because of the fear, or even belief, that smoke control areas will become areas in which all kinds of mechanical stokers will be in operation, their minimum smoke emissions varying widely, with some at least creating enough smoke to aggrieve the domestic user, who is compelled to be entirely smokeless.

This is not to suggest that mechanical stokers cannot be operated without smoke, or with so little that it does not matter, nor is it meant to suggest that it is not most desirable to encourage the installation of the best. The criticism arises from the blanket nature of the order. Exemptions could, and were, being given on individual application, after examination had shown that the installation would meet the standards required in a smoke control area. What need was there for an unqualified permission for the installation of *any* kind of mechanical stoker? The blanket covers not only mechanical stokers as a class, but every kind of stoker within the class.

Some mechanical stokers can minimize their smoke more readily, and have a lower minimum, than other kinds. The blanket is in fact a double one—not only may you install a mechanical stoker without approval, but you can choose either the best or the worst in respect of smoke-producing potential. A firm of consulting engineers, discussing the order with us, has written quite bluntly that the order is a retrograde step because " Various types of automatic stoker burn bituminous coal in a manner which is far from smokeless."

Another point of doubt about the order is whether the condition that smoke shall be minimized refers to the minimum that is possible for the particular type of stoker installed, for the particular installation considered as a whole, or for mechanical stokers in general. If it is the last, the minimum will be the smoke that is emitted from the best kind of stoker when it is maintained and operated at maximum efficiency. In that case no one will worry—there will be no smoke worthy of notice. But does it mean that, or does it mean (as we think it does) that it will be permissible to emit much more smoke than is really necessary because it is the minimum that can be secured from a less efficient type being used?

It is possible that the order may yet be debated or annulment sought in Parliament. The curious position is that such a Statutory Instrument has to lie on the Table in the House of Commons for forty Parliamentary sitting days, which period excludes any day on which Parliament is not sitting, or during prorogation, or during the period in which Parliament is dissolved. Assuming a General Election in October, this particular Statutory Instrument will have run only about ten or twelve of its Parliamentary days by that time, and the other thirty or so days will have to be counted in the life of the new Parliament. There is thus still a long time to go before the order becomes safe from the risk of an early grave.

No Vendetta

We are sorry that Mr. J. A. R. Machen, president of the Yorkshire mineworkers, should have referred at the recent N.U.M. conference to the question of clean air and what he called its " vendetta against coal." We can assure Mr. Machen that the campaign for clean air is no more a vendetta against coal than was, for example, the campaign against child chimney sweeps a vendetta against children. That was an attack on the shameful misuse of children, and it is about the misuse of coal to the injury of the community as a whole that we are so critical.

The Coal Fire Campaign

We may expect more advertising for the raw coal fire in the near future, but it is likely that the protests made by the N.S.C.A. and many others, and the publicity that has been given to the matter in this journal, have had their effect. We understand that it will be pointed out in such publicity that the solid fuel fire or stove need not depend on raw coal, but can use coal in its refined, smokeless forms. Although we may regret in principle that coal in its crude state should be boosted for domestic use, in practice fair references to smokeless solid fuels will make such advertising more bearable.

On another page we give some more information about the campaign to defend the raw coal fire, and of the organization that has been set up for this purpose. It is interesting to note the complaint that the coal fire has been subject to a " smear " campaign. Smear is a vogue word used to counter criticism when no better argument is available, and there is something rather comical about it being used in connection with the tarry smoke from house fires that so filthily smears everything on which it falls. The Coal Merchants' Federation, as will be seen from our account of their report, are conducting a general defence of the coal fire under cover of a plea that smoke control areas should be confined to the districts that really need them. The need to give priority to the black areas has always been recognized, and in point of fact very few smoke control proposals outside the black areas have been made. It is a factor that needs serious consideration, but when it is so obviously used as a rationalization for the defence of what is grandiloquently called " a great and beneficient British institution," the federation cannot really expect anyone to take seriously their professed support of the Clean Air Act.

Still less can we accept their protestations when it is being argued so fiercely that domestic smoke is not serious anyhow. In particular there is the cunning argument used by Mr. Locket, quoted in the report of a speech by him. He complains first of some chief public health inspector saying that domestic smoke is responsible for nearly half the total pollution, which, he declares, is " irresponsible, utterly untrue, and misleading." Then he goes on to show that, according to the Beaver Report, domestic *smoke* is responsible for only 10 per cent. of the total *pollution*. The slide from " smoke " to " pollution " is likely to have been accidental in the case of the unnamed inspector (who probably meant, and may have said, the total pollution from smoke), but with Mr. Locket it is certainly deliberate. The figures in the Beaver Report (which have since been revised and brought up-to-date) showed that domestic *smoke*, was responsible for nearly one-half the total *smoke*, and that domestic *pollution* (i.e. smoke, dust, grit and sulphur) was over 20 per cent. of the total *pollution*.

Mr. Locket and his friends (who are widely using this specious argument) should be aware that more recent work shows that domestic smoke may actually be over 90 per cent. of the total smoke (British Coal Utilization Research Association, *Smokeless Air*, Summer, 1959). They should also know that domestic smoke by reason of its high tar content and low emission level, is far more harmful than industrial smoke.

NEW CLEAN AIR ACT ORDER

Exemption of Mechanical Stokers in Smoke Control Areas

Section 11(4) of the Clean Air Act 1956, which relates to smoke control areas, empowers the Minister of Housing and Local Government, by order, to exempt any class of fireplace (meaning furnace, grate or stove), upon such conditions as he may specify, from the provisions of the section—if he is satisfied that such fireplaces can be used for burning fuel other than authorized fuels without producing smoke or a substantial quantity of smoke.

An earlier order exempted oil-burning furnaces, and there has now been one issued (No. 1207, 1959, in operation from July 17th) which exempts fireplaces equipped with mechanical stokers, and two specified stoves. The schedule giving details and conditions may be quoted in full:

SCHEDULE

(1) Class of fireplace	(2) Conditions
Fireplaces, other than fireplaces fired by pulverized fuel, constructed on or after 31st day of December, 1956, and equipped with mechanical stokers, or adapted on or after that date for use with such stokers.	The fireplace shall be so installed, maintained and operated as to minimize the emission of smoke. No fuel shall be used other than that for which the mechanical stoker was designed.
The fireplace known as the Solid Fuel Ductair Unit, manufactured by Radiation Limited	The fireplace shall be so installed, maintained and operated as to minimize the emission of smoke, and in any case in accordance with the manufacturers' instructions.
The fireplace known as the Fulgora Slow Combustion Stove, manufactured by Fulgora Stoves Limited.	The fireplace shall be so installed, maintained and operated as to minimize the emission of smoke, and in any case in accordance with the manufacturers' instructions. No fuel shall be used other than wood waste in clean condition.

The Ductair Unit is a downdraught smokeless furnace for domestic purposes, designed in particular for use in the whole-house warm-air heating system developed by Radiation Ltd. The Fulgora stove is designed, as indicated in the schedule, for the specific purpose of burning wood waste. It will be noted that any and every kind of stoker that can be described as " mechanical " is covered by the first paragraph of the Schedule. The order is discussed in our editorial notes.

SMOKE CONTROL AREAS

Progress Report

POSITION TO 31st JULY, 1959—TOTALS

	England and Wales	Scotland
Smokeless Zones (Local Acts) in Operation . .	44	1
Acres, 3,400		
Premises, 41,060		
Smoke Control Areas in Operation	47	1
Acres, 5,819		
Premises, 37,501		
Smoke Control Orders—		
Confirmed	95	2
Submitted	58	1
Proposals Notified	221	6
Not Confirmed (*Deduct*)	1	
Grand Totals	466	11

The lists given below are supplementary to the information in the last issue of *Smokeless Air* (Summer, 1959), which gave the position up to April 30th, 1959. They now show the changes and additions to July 30th, 1959.

Some of the areas listed are new housing estates, or areas to be developed for housing. The total number of premises involved will therefore increase. An asterisk denotes that there have been objections and that a formal inquiry has been or will be held.

ENGLAND AND WALES

New Smoke Control Areas in Operation

Edmonton B. No. 1, Hayes and Harlington U.D. No. 7, Kingston-upon-Hull C.B. Nos. 1, 2, 3, Leamington Spa B. No. 1, Liverpool C.B. No. 3, Oxford C.B. No. 2, Reading C.B. No. 1, Rotherham C.B. No. 1, Stockport C.B. No. 1, Wood Green B. No. 1, Willesden B. No. 1.

New Orders Confirmed but not yet in Operation

Brentwood U.D. No. 1, Brighouse B. No. 1, Crompton U.D. No. 1, Croydon C.B. No. 1, Droylesden U.D. No. 1, Dudley C.B. No. 2, Ealing B. No. 1, Hayes and Harlington U.D. Nos. 8, 10, 11, *Heston and Isleworth B. No. 1, Hornsey B. No. 1, Leamington Spa B. No. 3, Liverpool C.B. Nos. 7, 8, Middlesbrough C.B. No. 1, Middleton B. No. 1, *Rochdale C.B. No. 1, *Rotherham C.B. No. 2, Saddleworth U.D. No. 1, *Sedgeley U.D. No. 1, Sheffield C.B. No. 1, *Shipley U.D. No. 1, Southall B. No. 1, S.E. Derbyshire R.D. No. 2, Stalybridge B. No. 2, Stoke Newington M.B. No. 3.

Smoke Control Orders Submitted for Confirmation but not yet Confirmed

Aireborough U.D. No. 2, Brentford and Chiswick B. No. 1, Camberwell M.B. No. 1, Denton U.D. No. 2, Dudley C.B. No. 3, Felling U.D. No. 1, Horsforth U.D. Nos. 1, 2, 3, 4, 5, 6, 7, Leeds C.B. Nos. 2, 3, Mansfield B. No. 1, Newport C.B. No. 1, Nuneaton

B. No. 1 (Part I), Old Fletton U.D. Nos. 1, 2, Rochdale C.B. No. 2, Southgate B. No. 1, St. Marylebone M.B. No. 3, Sunderland C.B. No. 1, Wallasey C. B. No. 2, Wednesfield U.D. Nos. 1, 2, 3, Whitefield U.D. No. 1.

Proposals Notified to the Minister

Altrincham B. Nos. 2, 3, Basildon U.D. No. 2, Beddington & Wallington B. No. 1, Birmingham C.B. No. 4, Bolton C.B. Nos. 3, 4, 5, Bromley B. Nos. 1, 2, Burnley C.B. No. 1, Buxton B. No. 1, Carshalton U.D. No. 1, Coseley U.D. Nos. 1, 2, Croydon C.B. No. 2, Derby C.B. No. 1, Ealing B. No. 2, East Barnet U.D. No. 1, Failsworth U.D. No. 1, Feltham U.D. No. 1, Halifax C.B. No. 2, Hammersmith M.B. No. 2, Harrow B. No. 1, Hazel Grove & Bramhill U.D. No. 1, Hebburn U.D. No. 1, Hornsey B. B. No. 2, Kensington M.B. No. 4, Leamington Spa B. No. 5, Kingswood U.D. No. 1, Middleton B. No. 2, Nantwich U.D. Nos. 1, 2, Newcastle-under-Lyme B. No. 1, Oldham C.B. Nos. 1, 2, Oldbury B. No. 1, Paddington M.B. No. 2, Padiham U.D. No. 1, Preston C.B. No. 2, Prestwich B. Nos. 2, 3, Rotherham C.B. No. 8, Scunthorpe B. No. 2, Sheffield C.B. Nos. 2, 6, Smethwick C.B. No. 2, Solihull B. No. 1, Stalybridge B. Nos. 3, 4, 5, Stoke Newington M.B. No. 4, Thornaby-on-Tees B. No. 1, Urmston U.D. No. 1, West Bromwich C.B. No. 7, Widnes B. No. 1, Wilmslow U.D. No. 4, Willenhall U.D. No. 7, Worsley U.D. No. 1, Wortley R.D. No. 3.

SCOTLAND

New Smoke Control Areas in Operation

Nil.

New Orders Confirmed but not in Operation

Nil.

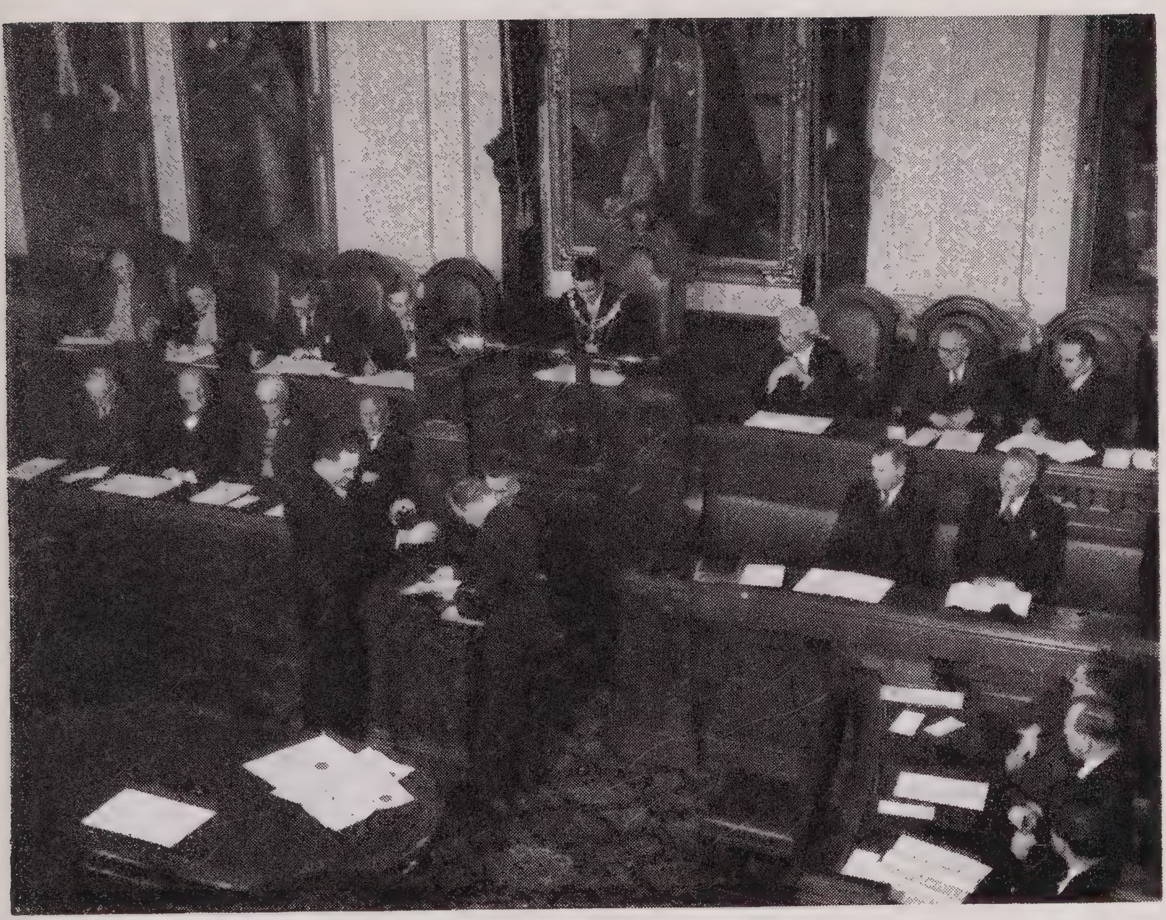
New Orders Submitted for Confirmation but not yet Confirmed

Nil.

Proposals Notified to the Minister

Paisley, Edinburgh (Sighthill No. 2).

A Conversion is Necessary: From " Windows in the Sky "



The Borough's Seal is affixed to the Order—another scene from the new film

"Windows to the sky"

Above, and opposite, are scenes from an excellent new film by the Gas Council, "Windows to the Sky," which is about the setting up of a smoke control area. In superb colour photography, with many striking shots, the film describes what has to be done when a local authority decides to set up a smoke control area—the planning, surveying, and the interviewing of those who will be affected. The photograph opposite shows an inspector explaining it all to a young couple (who are certainly in need of a more modern appliance), and above is the sealing of the final Order in the actual council chamber of a local authority that is making good progress in fact as well as in film. (No prizes are offered for identification.) We found the film interesting, informative and entertaining, and can recommend it without reservation to local authorities both for their own edification as well as for general publicity. Information about the loan of the film, and other details, can be obtained from the Films Officer, the Gas Council, Murdoch House, Grosvenor Place, London, S.W.1.

This is one of the films to be shown in the David Fisher Hall, near to the Seymour Hall, during the course of the International Conference.

First Motorway Fumes Conviction

Edward Noblett (35), lorry driver, of Whittle-hill, Woodplumpton, was fined 20s. at Preston recently for driving a lorry which gave off excessive smoke on Preston Motorway.

Noblett told police he knew he had been emitting smoke because he had been "pulling in top gear." When he changed down, he said, it had ceased.

DEFENDING THE RAW COAL FIRE

" Great and Beneficent British Institution "

THE annual report of the Coal Merchants' Federation of Great Britain has much to say about clean air, and shows how the trade has organized to oppose the implementation of the Clean Air Act in respect of smoke control areas. This is described as " strengthening its own organization to try to curb the extremists in areas where smokeless zones are really unnecessary." Reference is made to the " vast smear campaign against house coal," and the underlying emotional antagonism to the efforts for clean air is revealed by the statement that " If the future of the coal trade is still in doubt, the resolution of coal merchants to uphold a great and beneficent British institution is not."

To quote from the account of the report as given in the *Coal Merchant and Shipper:*

" Dealing with the Clean Air Act, the report refers to the action taken by the federation during the year to make use of the fund—£25,000 for 1959—which it receives from the increased C.U.C. levy to promote activities in defence of the coal fire and to finance the establishment of a special department of the federation with a headquarters officer and regional officers, to collect all relevant information on the subject, to advise the trade on clean air policy and generally to undertake and co-ordinate vigorous action nationally, and in the localities, to try to prevent the setting up of smokeless zones where these were ' unnecessary.' This modified the policy previously adopted by the federation of following the distinction drawn by the Beaver Committee between ' black ' and ' white ' areas. It was felt on closer examination that this distinction had always been an over-simplification of a complex problem, and no official lists of such areas have in fact ever been published. The distinction is ignored entirely in the Act itself, and has, therefore, no legal significance."

" So far, a headquarters officer with wide experience of local government—Mr. K. C. Knight, barrister-at-law—has been appointed, along with regional officers for the London, Eastern, South-Eastern, Midland, North Midland, North-Eastern and North-Western regions. Appointments for other regions are being considered."

" No quick or easy results can be expected," says the report. " For too long house coal has been, for one reason or another, unable or unwilling to defend itself against its detractors and much ground and goodwill have been lost which it will be difficult to regain.

Contradicting its own exhortation about defending " a great and beneficent British institution," the report plaintively says that " the federation is aware that its policy of opposing the indiscriminate and unnecessary establishment of smokeless zones can so easily be misrepresented as opposition to the Clean Air Act itself. " It is well, therefore, to reaffirm that the greater part of the Act is concerned with reducing pollution from industrial sources, which the trade fully supports, that the power of local authorities to create smokeless zones for domestic chimneys is entirely permissive, and that in any case it is no part of the federation's object to attack the principle of cleaner air which all responsible citizens must support."

" Its policy is intended to be pursued in a reasonable and responsible way and to have full regard for the merits of each case. Equally, however, it is resolved that, at long last, the case for house coal shall be heard as well as that for other solid fuels, and that the homely and cheerful open fire shall not be made the scapegoat for the misdeeds of others."

A Joint Meeting

A more hopeful sign of a change of heart on the part of the coal merchants was the holding, on June 16th, of a joint meeting of the Society of Coal Merchants, the Gas Boards and the Solid Smokeless Fuels Federation—the first meeting of its kind ever to be held.

Mr. Lionel Locket, described as Clean Air Advizer to the Society, had some reasonable points to make, getting nearer to some of the real problems that have to be considered in developing the smoke control area programme. He nevertheless made a reference to the relative quantities of smoke from domestic and industrial sources, which is being gleefully quoted by other coal trade propagandists, and on which we make a comment in an editorial note. Mr. Locket may be quoted at some length.

" The Clean Air Act," he said, " had been made permissive deliberately, the intention of Parliament being that only those parts of the country should come under control where air pollution was so serious as to be a menace. The Ministry of Housing and Local Government recognized this and had stated that efforts to establish smoke control areas were likely to be concentrated, certainly in the early years, in those parts of the country most liable to air pollution. The Beaver Committee had recommended that the first efforts should be directed at the ' black ' areas. The society attached considerable importance to these statements, because it felt that if, as a result of a failure to appreciate their significance, there was a too rapid establishment of smoke control areas, the whole implementation of the Act might receive a setback."

" A severe winter, with a possible and almost certain outcry from residents in smoke control areas that they could not obtain the smokeless fuels they wished for, could easily result in local authorities reviewing their position and deciding to slow down or even temporarily halt their programmes. An excess of enthusiasm might defeat its own object. It is the policy of the society to endeavour to ensure that the creation of smoke control areas is geared to the availability of alternative fuels, an attitude that is not always appreciated."

Misleading Statement

A chief public health inspector had said that about half the total air pollution of the country originated from domestic premises. " That is an irresponsible, utterly untrue, and misleading statement," declared Mr. Locket. The Beaver Committee, he continued, had estimated that domestic smoke accounted for only about 10 per cent. of air pollution. Misleading statements were too often made and too often allowed to go unchallenged.

The Society felt it would be wrong to oppose the creation of smoke control areas in such places as, say, Stratford and Bromley-by-Bow, and equally wrong to stand quietly aside without issuing a warning that areas not felt to be making a significant contribution to air pollution would, if established, increase the pressure in the winter on fuels urgently required in seriously affected areas. The society was not inimical to coke, but was apprehensive lest there should be a breakdown in supplies. Last winter, a mild one, gave rise to considerable anxiety about domestic supplies, particularly of smokeless fuels, yet in London alone, of some 90 smoke control areas confirmed or awaiting confirmation and requiring some additional 112,000 tons of solid smokeless fuels, only 12 were in operation, requiring about 12,500 tons.

The problem was an enormous one, went on Mr. Locket, and the replacement in a short space of time of an annual consumption of 19,000,000 tons of bituminous coal (and that referred only to the black areas) was a colossal undertaking. For the solution they must obviously look to coke and coke " of a nature which must give service which the normal consumer will regard as satisfactory."

The coal trade would try to remove the long-standing and deep-rooted objection on the part of many consumers to coke, but it would be no easy task. Meanwhile the pressure for other smokeless fuels was going to be constant and ever-increasing and it would be the coal merchant who would have to bear the brunt of criticism if the demand could not be satisfied. It was true that coke users in controlled areas were in the main satisfied, but about 30 per cent. refused to make the necessary conversion of appliances and the great majority of these had gone over to paraffin.

Reply from the Gas Industry

Mr. F. C. Longhurst, of the North Thames Gas Board, made a forthright and plain-speaking contribution. He said that they must give full support to the clean air movement and present a united and helpful front to central government, local planning authorities and the public. They must rely completely on the Minister's final appraisal of the overall supply of all smokeless fuels to such areas, whether they be the open-fire cokes, the premium fuels, gas, electricity or oil. They must move forward together to educate the people in the value of installing modern solid fuel appliances with modern forms of ignition, and they must look seriously to the training and education of staff in contact with the public on the value of installing modern appliances which would burn any smokeless fuel available.

" The gas industry's policy of unstinted encouragement for the development of any smoke control area," continued Mr. Longhurst, " together with the full support of an adequate supply of selected cokes suitable for domestic use, was based on its gospel of smoke abatement and the intelligent use of coal by carbonization preached over the past 150 years."

Mr. Longhurst said he believed the Clean Air Act to be the greatest piece of social legislation for the past hundred years. In the next ten or twenty years it would change the whole pattern of domestic heating. As surely as wood was supplanted by coal, the new smokeless fuel age was upon them.

As a finger pointing the way ahead to the smokeless age Mr. Longhurst reminded the meeting that gas on a two-part tariff could now in certain circumstances offer lower cost heating than the cheapest house coal or paraffin. " We are now at the stage of being able to take raw coal and from it produce two smokeless fuels, both of which can offer heating at a lower cost than can be achieved by burning the original raw coal."

Mr. Longhurst said he was amazed and distressed at the lack of foresight and business acumen that at times arose from a section of solid fuel distributors. There was a section taking every step to resist the development of clean air legislation. It was a small but vociferous group and it was doing irreparable harm to the solid fuel distributive trade. The effect of such consistent negative approach and lack of support had only strengthened the determination of local authorities to have clean air—if necessary by the use of smokeless fuels other than solid fuels.

West Germany to have Smokeless Zones?

Committees of the lower house of the West German Parliament are working on a bill to combat air pollution following scientific estimates that about 1,000,000 tons of dust and soot settle on the land each year. It is hoped that the bill will come before Parliament in the Autumn.

In some areas of the Ruhr, about 320 tons of dust is estimated to fall on one square kilometre (·386 square miles) every year.

The report of the special commission of enquiry into air pollution set up in 1955 by the German Engineer's Association, says that in the years following 1945, about £30,000,000 Sterling, was spent by industry on equipment to trap dust and ash.

(*This news will be the subject of papers at the forthcoming International Clean Air Conference.*—Ed.).

Warren Spring

New Laboratories Opened

The new Warren Spring Laboratory of the Department of Scientific and Industrial Research was formally opened at a ceremony on 29th June by the Rt. Hon. Viscount Hailsham. Our own interest in the laboratory is because it takes over the work on atmospheric pollution formerly done by the now deceased Fuel Research Station.

This work is in fact still being carried out at the old station at Greenwich, but will be transferred to the new laboratory early next year. Other current research at Warren Spring is on chemical process development, mineral processing, and chemical engineering research. The laboratory is described as being designed to assist Government departments and industry by research and development work over a wide field of science and technology. It has been equipped in particular for work on a pilot scale, and industry is invited to take advantage of the facilities available for sponsored or repayment work. The central services include chemical analysis, spectography, workshops, instrument development, photography, intelligence, library and administration.

On a first visit one is initially impressed by the environment of Warren Spring in comparison with the old station at Greenwich, and secondly by the planned and spacious layout of the buildings. They occupy a 28-acre site at the south-western corner of Stevenage New Town. The main building consists of a three-storey block 272 feet long, with an administrative and library wing of three storeys 125 feet long.

There are three pilot-scale laboratories, 90 by 55 feet, each with a 10 ton crane and with 30 feet head room under the crane beam. Large folding doors along the sides of the laboratories provide access to the building for large items of equipment. Workshops and engineering stores occupy a large steel-framed building

A Member of the Warren Spring Staff with a Standard Deposit Gauge

comprising six east-light bays. Steam for heating and process work is generated in two automatic oil-fired boilers, and a special plant is provided to supply synthesis gas (a mixture of carbon monoxide and hydrogen, for work on the Fischer-Tropsch process) at a rate of 4,500 cu. ft. per hour at a pressure of 120 atm.

The buildings are designed to accommodate staff of about 340, of which a hundred have scientific or technical qualifications. The site and the design of the buildings will readily permit of extension to all the facilities should future expansion of the work demand it.

AIR ENGINEERING

Many of our readers will be interested to hear about a new monthly journal, *Air Engineering*, from the U.S.A. It covers the fields of air pollution control, air moving and air conditioning, and the issue we have before us contains many articles, a variety of news items, and information about new plant and apparatus. It is published by Business News Publishing Company, 450 West Fort Street, Detroit, 26, Mich. Single copies are 50 cents., and the foreign subscription rate is $5 a year.

A.P.C.A. Change—Harry Pier, executive secretary of the Air Pollution Control Association of America since 1957, retired from the post on July 1st, and has been succeeded by Arnold Arch, B.SC. Mr. Arch has served as director of the Air Pollution Control Department for the city of Niagara Falls since 1953.

The 52nd annual meeting of the A.P.C.A. was held in Boston in June, with a very full and interesting programme. We hope to be able to report, or give abstracts on, some of the papers in future issues.

The Air Pollution Laboratory—soon to be rehoused at Warren Spring

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COALITE

The Directors' report for 1958 shows that Coalite and Chemical Products Ltd., and its subsidiaries, have had another successful year, with in particular the demand for Coalite continuing to exceed the supply. A final dividend of 10 per cent. makes a total of 13 per cent. for the year. The original batteries of retorts at Askern have been modernized and their capacity enlarged, and a similar programme for the original retorts at Bolsover is to be undertaken.

The Chairman, Commander Buist, in his report, refers to the Clean Air Act, and says that " the way is clear for a concerted attack on air pollution. The ball is at the feet of the local authorities and it is up to the citizens on the side lines to ensure that they make good use of it."

A Way to Dispose of Garden Refuse

Bonfires of garden refuse do not always lead to the best neighbourly relations, and while the best method of disposal is the compost heap, there is at times, a temptation to use the dustbin. Dustbins are for domestic refuse and not garden rubbish however.

Birmingham has solved the problem, for a special sixpenny ticket purchased from the salvage department, ensures that one standard binful of garden rubbish is taken away at the same time as the domestic collection. Tickets can be bought singly or in books of five.

The Salvage Department are also prepared to make quotations for special collections of large accumulations.

NEWS FROM THE DIVISIONS

EAST MIDLANDS

Visit to Scunthorpe

Sixty members of the East Midlands Division, who visited Scunthorpe for the Division's annual meeting, toured three of the town's steelworks. Later, they discussed air pollution with a team of works representatives. Mr. G. Brooks, of the Appleby-Frodingham Steel Co., described his company's work in cutting down the amount of pollution.

Mr. Brooks said that during the last four years his firm had been able to prevent about 90 per cent. of the dust and grit actually involved in the processes from being emitted into the air. Every day a total of 133,000 tons of gases was discharged into the atmosphere from the works. They contained a potential dust and fumes emission from all assessed sources of 521 tons per day, but because of the efforts already made to prevent pollution the actual daily emission amounted to only 53 tons.

After dealing with the methods used to reduce the emissions from the ore preparation plant and other sources, Mr. Brooks spoke of the problem of fine oxide fume from the oxygen lancing process. This fume, known as the " red menace " was very fine—little coarser than tobacco smoke. This had advantages and disadvantages. The advantage was that it should remain airborne for a very long time and with normal prevailing winds more would be dropped in the North Sea than on the town. The disadvantage was that its very fineness caused it to appear very thick and to obscure the light. Another difficulty

Members of the East Midlands Division at the Appleby-Frodingham Steel Company (branch of United Steel Companies Ltd.). Photo by courtesy of the Company

The Scottish Division visits the Carnation Milk Factory at Dumfries. Note the aluminium faced stack, which cured an oil smuts problem

was that it was very " difficult to catch " and only the more refined and therefore more expensive equipment would be suitable.

After the tour, the business meeting of the Division was held in Charter Hall, where members were welcomed by the Mayor of Scunthorpe, Councillor A. Moore. Mr. G. A. Hiller, of Leicester, was re-elected chairman of the divisional council, and Councillor C. A. Watson, of Scunthorpe, vice-chairman. Mr. A. Wade, of Nottingham was re-elected Divisional Secretary.

Scottish Divisional Conference

The Society's Scottish Division, under the chairmanship of its President, John Innes, held a most successful and well-attended conference at Dumfries on May 21st and 22nd. On the first day Dr. R. J. Peters, of the Department of Health for Scotland, read a paper on " Atmospheric Pollution and Health—Recent Medical Views," while on the Friday morning the industrial aspects of the Clean Air Act were discussed. Mr. Thomas Ashford, of Glasgow, read the paper on grit and dust emission that he had presented at the national conference at Llandudno last year, and the Chief Alkali Inspector for Scotland, Dr. E. A. B. Birse read a paper which is reproduced in full on another page.

On the Thursday afternoon a visit was paid to the Dumfries factory of General Milk Products, where delegates saw the well-known " Carnation " milk being prepared and canned under ideal conditions. The factory had been troubled with smuts from the stack of its oil-fired boiler plant, but this had been completely cured by the installation of an insulated stack, faced with aluminium—the first time this new technique had been used in Scotland. The stack is shown in the accompanying photograph, taken during the visit.

The Provost of Dumfries entertained

the delegates to lunch on the Thursday, and the hospitality was reciprocated by the Division at a lunch on the Friday. The conference concluded, at the luncheon table, with a brief report on smokeless zones and smoke control areas by the Director of the Society, Arnold Marsh, whose comparison of progress being made in England with that in Scotland stimulated the audience into a lively discussion.

Yorkshire Division Visit Smokeless Fuel Plant

Members of the Yorkshire Division visited the Manvers Main Coking Plant at Wath on May 25th. They were addressed by the manager Mr. Wallis, who told them that carbonization of coal can never be a completely clean operation. He went on to say: " Our aim is to make it just as clean as we can." One of the most serious problems they were encountering in their efforts to make their plant a model one, was the problem of ' black pushing '—smoke emitted from the tower when the coal emerges from the ovens as coke.

Photo-Library *H. C. F. Kapps*

Face Wash

Photograph of Big Ben taken recently (from Palace Chambers), showing repeat of face cleaning after the major cleaning operation only two years ago.

The N.C.B. Report

National Coal Board, Report and Accounts for 1958, H.M.S.O. 3s. 6d.

THE year under review was one of considerable difficulty. The general trend up to 1956 had been economic expansion with an increasing demand for coal, whereas in 1957 stocks of certain grades of coal began to accumulate and at the end of the year total stocks at collieries and opencast sites amounted to 8·6 million tons.

The problem facing the Board was to maintain the productive capacity of the industry and at the same time to reduce output to avoid the mounting surplus of some grades of coal. With this in view it was decided to suspend recruitment, to curtail overtime, to discontinue Saturday work from the end of April and to advance the closure dates of twelve pits nearing exhaustion.

By the end of the year inland consumption had fallen by 10 million tons and exports by 3 million tons on the previous year and notwithstanding measures taken to reduce output, stocks at the end of the year amounted to 20 million tons.

After taking all possible measures to raise efficiency and reduce costs and after putting into stock coal and coke of the value of £13 million, the Board, after allowing for taxation provisions no longer required, made a net loss of £3·5 million.

In formulating plans for 1959, the Board decided that stocks could not be increased by more than 3 million tons, and output had to be reduced by a further 6 million tons. To this end it was decided to cut opencast production by 3 million tons about 25 per cent., the largest cut that could be made without expensive breaking of contracts, and in addition to close an additional 36 collieries producing some 2·5 million tons of coal at an annual loss of about £4 million. Some 12,000 men were affected by these closures but by restricting recruitment at neighbouring collieries and by transfers it is hoped to find employment within the industry for at least three-quarters of these.

The total output during 1958 was 215·8 million tons including 14·3 million tons from opencast working, and the average colliery manpower 698,000, a drop of 22,600 during the year. The power-loaded output was 66 million tons, 28 per cent. of the deep mined output. The Board is carrying out experimental work with a view to increasing the amount of large coal produced by loaders.

With the increase in mechanized mining and the working of thinner and banded seams, the need for cleaning and grading has become more urgent, and during the year 22 new plants came into operation, and 63 were planned or under construction. As a result 125 million tons of coal were mechanically cleaned.

At the end of 1958, 79 major colliery reconstruction schemes had been completed and the output from reconstructed collieries is steadily increasing. The Board is continuing research into underwater reserves of coal by the use of off shore boring towers and work is in progress in the Firth of Forth and off the Durham coast.

The Board's coking plants produced 7,303,000 tons of coke and breeze, 800,000 tons less than the last year, 399,000 tons of crude tar, 29 million gallon of crude benzole, some 90 million tons of ammonia products and 56,000 million cubic feet of gas. The demand for furnace coke fell by some 850,000 tons, exports of coke fell to about one third of the previous year but market for domestic and industrial coke was maintained. The " Phurnacite " plant produced 723,000 tons of " Phurnacite."

During the year full production started at new coking plants at Avin in South Western Division and at Murton in Durham. To balance the decline in demand and to offset production from these new plants, it was decided to close three plants in Durham, three in North Eastern Division and two in South Western Division. Output in ten other plants has been reduced.

The Board has been studying the possibility of underfiring coke ovens by gas made by the total gasification of low grade material extracted from coal in washeries, thus rendering available for disposal the rich gas that would otherwise be used for underfiring.

Warmco

A new smokeless fuel, sold under the name of " Warmco " was produced at Grassmoor coke ovens and if the demand is sufficient it is proposed to turn over other plants to its production. The Coal Research Establishment is devising new processes for making open fire smokeless fuel from non-coking coals.

The Board has made arrangements for supply of opencast coal from Westfield for the Lurgi total gasification plant of the Scottish Gas Board. The experiments on underground gasification of coal have been discontinued.

Oil consumption in fields where coal could be used has increased since 1956 by the equivalent of 8 million tons of coal, power stations alone accounting for 3·8 million tons. The Board is pressing for general exemption, under the Clean Air Act as is accorded to oil-burning plant, for coal-burning appliances which comply with the Act.

Apart from the technical services of N.I.F.E.S., B.C.U.R.A. and C.U.C. which it supports, the Board is strengthening its technical services to advise consumers in the use of coal, and is also collaborating with appliance manufacturers in the production of more efficient appliances.

The departmental committee set up by the Ministry of Fuel and Power in 1956 reported that wholesalers' charges were not open to serious criticism and that the Board's own charges left little room for profit. It also recommended that distribution should be concentrated in a smaller number of larger units.

The capital expenditure of the Board during the year amounted to £104 million of which £90 million was spent on collieries and the remainder on ancilliary plant such as Coke Ovens, workshops, &c.

The Board is continuing its programme of research—improving the efficiency and extending the scope of mechanization at the coal face, methods of roof support involving hydraulic and mechanical yielding props and self-advancing supports, shaft sinking and tunnelling, &c.—*A. J. C.*

BRADFORD'S CLEAN AIR LEAD

The Editor,
Smokeless Air

Sir,—My attention has been drawn to the mention of Bradford, and its hope of becoming Britain's first smokeless city, in your Spring issue, No. 109, page 181.

You may be interested to know that Bradford was the first city to operate trolleybuses in 1911, and whilst these vehicles were not introduced at that time with any regard to the question of atmospheric pollution, it will be realized now, of course that this fleet of trolleybuses, of which we operate nearly 200, does materially help to reduce atmospheric pollution in Bradford.

Yours, etc.,
CHACELEY T. HUMPIDGE
General Manager,
Bradford City Transport.

Correction—We apologize for an error in the caption to the photograph that appeared on page 270 of our Summer issue. The lady on the right, with H.R.H. the Princess Royal and Mr. Winfield was in fact the Worshipful the Lord Mayor of Leeds. Also, on page 266, the remarks on the " cosy coal fire " by Councillor F. V. Magness, were made at a meeting of the West Bromwich Clean Air Council, and not to the Warwickshire Clean Air Council.

ELECTRICITY IN SCOTLAND

North of Scotland Hydro-Electric Board. Annual Report and Accounts for 1958. H.M.S.O., 5s.

THE water power resources of the North of Scotland are being utilized to an increasing extent for the generation of electric power. During the year an additional 84,000 kilowatts was brought into commission, bringing the total hydro-electric plant to a capacity of 813,000 kw. A further 170,000 kw. is under construction, 448,000 kw. in course of promotion and 224,000 under survey. Among the plant completed were that at Shin and the increase in water storage in Glen Shira. The Board has used ground blast furnace slag and fly ash in concrete whereby some 53,000 tons of cement has been saved.

The Awe scheme under promotion includes a pumped storage project at Cruachan of 400,000 kw. of combined pumping and generating plant. Its purpose is to use the surplus capacity at night and during the weekends to raise water to a high level storage reservoir for use during periods of high demand. The possibility of having reversible pump turbines instead of separate machines is under investigation.

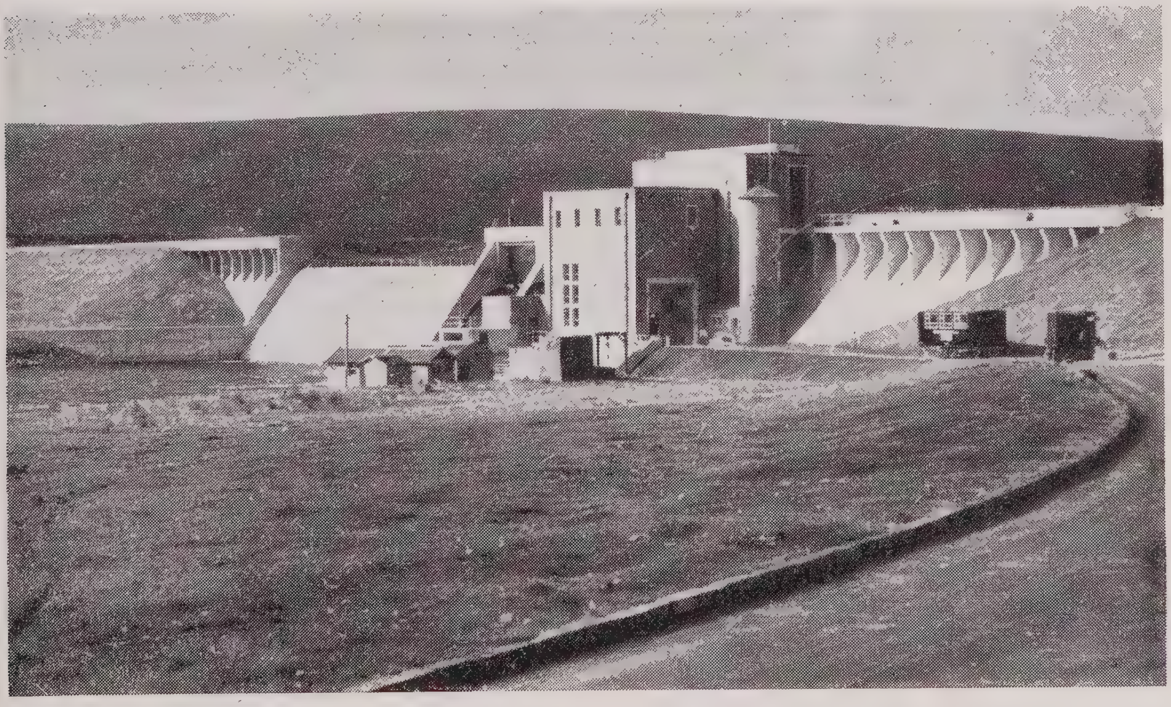
In addition to the hydro-electric plant, the steam stations at Dundee, 75,625 kw. and Aberdeen, 57,250 kw. remain in use, together with some 50,000 kw. of diesel plant on the mainland and on the islands.

For the second time in four years, the rainfall in the Board's area was below the average, on this occasion by 14 per cent. The records from 26 selected gauge stations show all but two considerably below average.

The cost of generation from water power was ·727d., by steam power 1·054d., by diesel power 1·77d. per unit, while power from the South of Scotland Board cost ·707d. per unit.

During the year 1,683 million units were generated at hydro-electric stations, 294 millions at steam and 66 millions at diesel stations. 73 million units were bought from the South of Scotland Board.

The peat-gas turbine at plant Aldnabreae in Caithness has been run



The Cairg Dam and Power Station—illustration from the North of Scotland Hydro-Electric Board's Report

Dams in Glen Shira

on trial, and it is expected to be in full commission during 1959.

The length of 132 kv. transmission lines in use increased from 1,500 to 1,630 circuit miles and an additional 250 miles is in course of construction. Transmission lines operating at 275 kv. are contemplated.

New consumers connected during the year numbered 9,997 bringing the total to 374,199, comprising: domestic 300,332, crofts 13,266, farms 12,789, commercial 40,302, industrial 7,179 and public lighting 331.

An interesting development has been the introduction of a battery-driven railcar on the 43-mile long railway line from Aberdeen to Ballater. Charging facilities exist at both ends of the line. This type of railcar should permit lines that otherwise might be closed, to be kept in operation.

The Board gives great attention to research, and at present is directing attention to the design of hydraulic structures, generator stability, earth sensitivity, fault-finding by high frequency pulsing, snow and wind loads on high ground and water flow. It also gives particular attention to the conservation of fish.

The revenue from the sales of electricity to consumers amounted to £9,663,240 and to the South of Scotland Electricity Board to £3,034,946, giving a surplus on trading of £1,163,186. After meeting capital and other charges there was a loss on the year's working of £112,238. The accumulated loss since the inception of the Board amounts to £724,456.

The collaboration between the English Electric Company and Messrs. Harland and Wolff whereby hydraulic turbines and generators are manufactured at the latter's works at Scotstoun has continued, and two and a half million h.p. of turbines have been constructed. The Harland Engineering Company has opened an extension to its works at Alloa to meet increasing demands from abroad for water turbines.

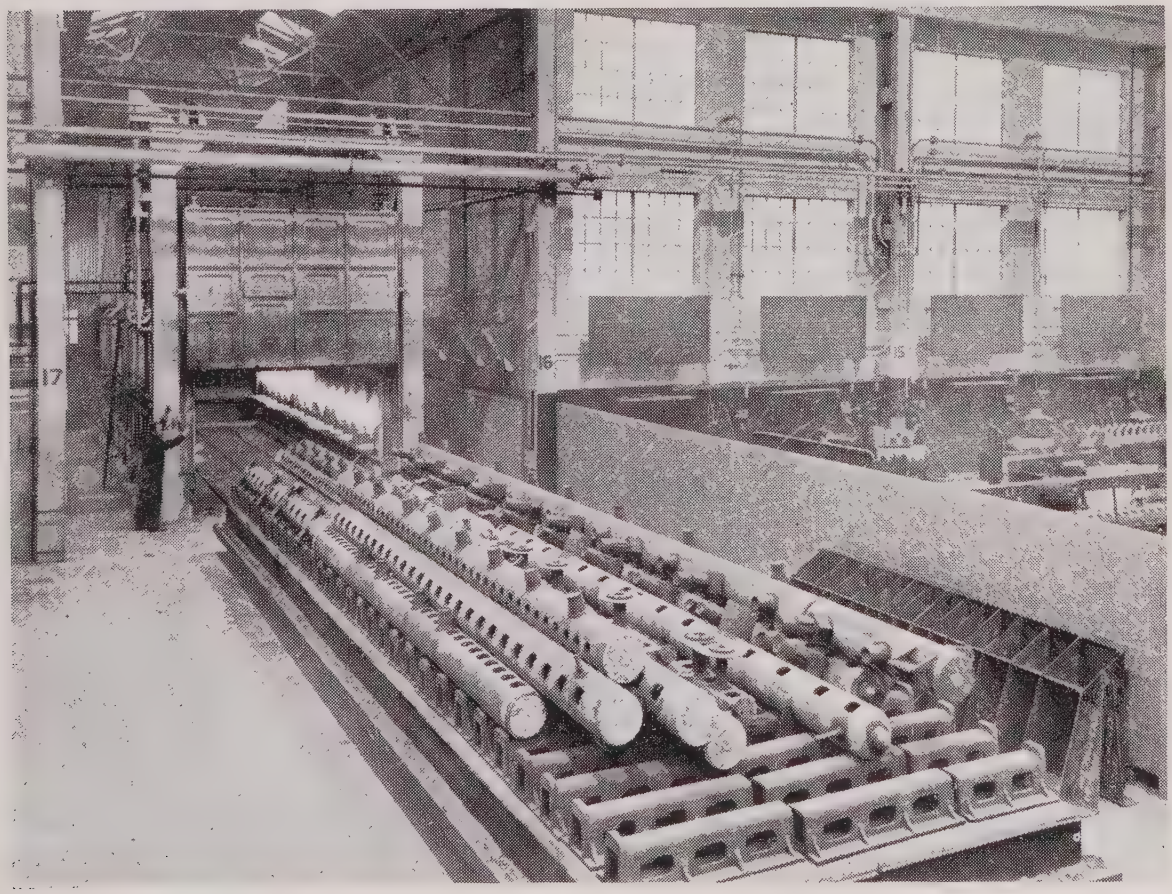
GAS IN SCOTLAND

The Scottish Gas Board was established on May 1st, 1949 and to record its activities during the ten years of its existence, the Board has issued a special report entitled *Gas in Scotland*.

The year 1958 has in Scotland been notable for the outstanding projects started or approved to extend the equipment of the country to meet modern demands. The new road bridge across the Forth was commenced, decision was taken to erect a strip mill in Lanarkshire, plans matured for a tunnel under the Clyde at Whiteinch and the electricity industry continued to expand—the new large power station at Kincardine-on-Forth, the nuclear power station at Hunterston of the South of Scotland Board and the progressive development of hydro-electric plant by the North of Scotland Board.

The Scottish Gas Board is making an equally significant contribution to the national equipment and has taken the decision to erect at a cost of some six and a half million pounds a Lurgi high-pressure complete gasification plant to operate on low grade opencast coal at Westfield on the borders of Fife and Kinross, associated with a high pressure 12 inch steel main extending from Dundee to Coatbridge. (See *Smokeless Air*, Summer, 1958). This is the pioneer Lurgi plant in Great Britain.

On May 1st, 1949, the Gas Board inherited 194 gas-producing plants using good quality gas coal that was becoming progressively scarcer. Eighty of the more inefficient plants have been closed down and production concentrated in the more efficient units, and new sources of gas—coke



Gas-fired heat treatment furnace at Babcock and Wilcox Ltd.—from the Scottish Gas Board's Report oven gas from steel works, gas from oil refinery, methane from collieries—have been secured. To enable distribution to be effected 1,300 miles of new mains have been laid.

Large and efficient conventional gas works are being modernized and extended, the largest being the Provan works in Glasgow, which with supplies of colliery methane and coke-oven gas, is expected to attain a daily output of 40 million cubic feet per day.

A universal tariff has been introduced for consumers over the whole of Scotland.

The full provisions of the Clean Air Act of 1956 were applied to Scotland on January 1st, 1959 and the first Smoke Control Area came into operation in the Sighthill Estate in Edinburgh, containing over 1,000 new and a few old houses. All old unsuitable appliances were removed and replaced by suitable open fires and generally gas ignition has been installed. All residents were given a copy of the Gas Board's instructional leaflet ' Your coke fire—and how to use it,' and where difficulty has been experienced, demonstrations were given as to the proper use of a coke fire. Preliminary sanction has been given for a Smoke Control Area in the centre of Glasgow.

In anticipation of the increased demand for coke by industry and the domestic market, the Board is improving the quality of coke, particularly in respect of sizing, and new coke preparation plants have been brought into commission.

For domestic supplies of gas, an optional two-part tariff has been introduced throughout the whole of Scotland, and many new efficient domestic appliances—convector fires, automatically controlled cookers, instantaneous water heaters and gas refrigerators have been introduced.

In the major towns radio-telephone systems are in vogue to control and expedite the operations of emergency service vans working 24 hours a day. All new appliances sold by the Board bear the ' Seal of Approval.'

The sales of gas to industry during the previous year increased by 9·3 per cent. and the Board has increased its specialist staff to provide technical information and advice to industrial users. The largest users are engineering and shipbuilding firms, for example for annealing and stress-relieving of superheater and economizer elements at temperatures of from 650°C. to 950°C., while considerable use arises from light engineering activities in industrial estates.

For factory services, a range of efficient gas-fired catering equipment, instantaneous and bulk storage water heaters, space heaters, etc., is available.

Dr. T. P. Colclough—Dr. Colclough, a member of the Society's Executive Council and Chairman of its Technical Committee, has recently been honoured by the degree of Doctor of Metallurgy being conferred upon him by the University of Sheffield.

Fumes Inspector for Auckland

The New Zealand Ministry of Health are considering appointing a fumes inspector to help in combating the city's serious pollution problem.

Smog in Budapest

Efforts to combat Budapest's gradually worsening air pollution problem are to be started later this year. It has already hampered the work of the observatory on the outskirts of the city and a new one is to be built a safe distance away in the Matra Mountains.

Dark Smoke Warnings for Cross-Channel Steamers

The Dover Health Committee are sending warning letters to the Harbour Board and British Railways about dark smoke emitted from their vessels in the harbour. Since the Clean Air Act came into force a special watch has been kept on vessels in the harbour. So far two offenders have been reported—the Harbour Board's dredger and the British Railways' steamer *Isle of Thanet*.

THE INDUSTRIES SCHEDULED UNDER THE ALKALI ACT

By E. A. B. Birse, B.Sc., Ph.D.

Chief Alkali Works Inspector, Department of Health for Scotland

A Paper read at the Annual Conference of the Scottish Division of the National Society for Clean Air, Dumfries, May, 1959

WHEN the Beaver Committee on Air Pollution got down to their work of investigating air pollution they did not need to spend much time in identifying combustion of fuel as by far the main cause of pollution. Discharges of waste industrial gases such as acidic fumes, metallurgical fumes, mist-forming fumes and certain specific chemicals make relatively small contributions to the overall pollution in the country as a whole. On the other hand, the Committee fully realized that such industrial discharges could be major local problems in the areas where they occurred and they took them into account when making recommendations on dealing with the general problem of pollution by combustion.

As you know, the evidence which the Committee received led them to the conclusion that with few exceptions no industrial chimney need emit more than a light haze of smoke from the combustion of fuel. They went on to recommend, subject to necessary exceptions, the prohibition of dark smoke which they defined as smoke equivalent to or greater than Shade 2 on the Ringelmann chart. The Committee would have liked to be as precise in dealing with grit and dust emissions but the evidence before them showed inherent difficulties in laying down a maximum tolerable limit of emission. Nevertheless they felt it essential to recommend that all reasonably practicable steps be taken to prevent emission of grit and dust.

Having reached these general conclusions about dealing with smoke, grit and dust from combustion, the Beaver Committee had to consider particular industrial cases which would have difficulty in complying with their ideas. There was no doubt in their mind that the bulk of the fuel used by industry could be burned well within their recommendations, particularly fuel burned in steam raising. Moreover they were convinced that in the great majority of these cases reduction of smoke, grit and dust was economically sound as well as socially desirable. As always, however, there were exceptions where the evidence pointed to technical difficulty in reducing smoke, grit and dust. Many of these exceptions were industries vital to the national economy. In scale of operation and amount of emission, the greatest group of exceptions was in parts of the iron and steel industry. Other industries with difficulties were the production of non-ferrous metals, the generation of electricity, the production of coal gas, the manufacture of coke, manufacture of brick and pottery and the production of lime. Some of these industrial processes had technical difficulty in the smokeless combustion of fuel but at least as many had problems in which difficulty in combustion was only a minor or even negligible part.

Although some parts of the country had concentrations of these special industrial processes, the parts where they were to be found tended to be widely separated. Again the technical problems had much in common with other industrial processes in the chemical and allied industries which had for long, only four years short of a century, been regulated by the provisions of the Alkali, &c., Works Regulations Act, 1906 on account of their difficulty in complying with general public health legislation on prevention of nuisance conditions. The Beaver Committee decided that it would be best to deal with the cases of special difficulty in relation to their ideas by recommending that they should be scheduled as industries subject to the provisions of the Alkali Act. When so scheduled, the industries would be required to take the best practicable means to prevent the emission of smoke, grit, dust and other noxious or offensive gases and, where discharge was inevitable, to render such emission harmless.

As you are well aware the Clean Air Act, 1956, gave effect to the recommendations of the Beaver Committee and in due course representations were received from industry and local government about the scheduling of industrial processes under the Alkali Act. In England the Statutory Inquiry required by that Act was held about these representations in the course of 1957 and in 1958 an Order was made scheduling those processes which were considered to have special difficulty in complying with the Clean Air Act. In Scotland it was necessary to hold a separate Statutory Inquiry and it was decided that to simplify procedure for all parties the outcome of the English Inquiry should be awaited. The Scottish Inquiry was held in April, 1958, and one representation of particular interest to Scotland was raised about difficulty in avoiding smoke emission during the recovery of caustic soda at paper mills. It was decided to schedule this process in Scotland but otherwise the list of processes scheduled in Scotland is more or less identical with that in England and Wales.

The principal industries which became scheduled as a result of the Alkali, &c., Works (Scotland) Order, 1958 were:

Iron production
Steel production
Copper melting and casting
Aluminium recovery
Electricity generation
Gas production
Coke production
Brick and pottery manufacture
Lime burning
Soda recovery in paper making.

A brief review of some of these industries may illustrate some of the specific problems to be tackled.

Iron production

The extraction of iron from its ores in blast furnaces involves dusty rather than smoky operations. In handling iron ores themselves much dust can arise and the industry has set up a small Working Party to look into the problem of reducing dust. The Alkali Inspectorate are represented on this Working Party. Basically the problem is one of enclosing the ores as much as possible during handling but the scale of operation makes achievement of this aim a major engineering problem.

Iron ores are now commonly sintered before the extraction of iron in blast furnaces. Sintering is a process to convert finely divided iron ores into a granular state for the blast furnace. A blend of ores mixed with coke and lime is fed on to a form of travelling grate called a strand where the coke is ignited and as the grate travels along the blend of ores fuses together. Combustion gases are extracted below the strand and, as one would expect, they have a high grit and dust burden together with a sulphur dioxide content which depends on the sulphur in the ores being sintered. Scottish sintering plants are provided with equipment to arrest grit and dust but the industry recognizes that there is scope for seeking improvement in some of the equipment.

In blast furnaces a burning mixture of coke, iron ore and limestone is subjected to a blast of pre-heated air to reduce the ore to molten iron. The gases coming from blast furnaces are low in sulphur dioxide but they contain a high burden of grit and dust. The carbon monoxide in the gases gives them a value as a fuel and they are burned to pre-heat the air entering the blast furnaces, to raise steam and to heat the ovens for making the coke for the blast furnaces. The gases have to be cleaned for these purposes and the standard of dust removal is often as high as that attained in air-conditioning plants for public buildings. From time to time surpluses of gas arise and sometimes uncleaned surplus gas is bled to the air. In Scotland, however, the industry has a predominance of modern plant and its general policy is to bleed only cleaned gases.

Steel production

Iron contains carbon and reduction of this carbon to under 2 per cent., along with adjustment of other elements in the iron, is the basic process of steel making. The reduction of carbon is brought about by burning it to carbon dioxide. Two types of furnaces are commonly used for this purpose, the Bessemer and the Open Hearth.

Historically, the Bessemer furnace was the foundation of large-scale steel making. In this furnace the carbon in a charge of molten iron is burned by blowing a blast of air through it from the bottom. It is a spectacular operation producing a great volume of flame, grit and fume at the mouth of the furnace which cannot readily be collected as the furnace normally has to be tipped for pouring the steel. In Scotland, examples of this type of furnace are limited to a side-blown version which is operated on a comparatively small scale. The solution to the pollution problem of the Bessemer furnace is being sought in all steel making countries. A solution to the problem of the smaller side-blown Bessemer might well come first.

The Open Hearth furnace has to a great extent superseded the Bessemer in the United Kingdom. In this furnace iron is melted in a bath lined with refractory brick. Heat for the furnace is supplied by oil or gas burners above the iron. When the iron has been brought to the boil in the furnace under a blanket of molten lime slag, oxygen is provided to burn the carbon by adding iron oxide either in the form of iron ore or as iron scale. Other chemical elements in the iron can be removed or reduced by boiling until they combine with the slag, where necessary, they may be added to the molten steel.

The economical working of Open Hearth furnaces requires recovery of heat from the waste gases. Heat is recovered by passing the waste gas over chequered brickwork in chambers under the furnace. The heat soaked up in the brickwork is then used to pre-heat the combustion air for the oil burners. Two chambers of chequered brickwork are provided so that by reversing the flow of gases one is soaking up heat while the other is pre-heating air. It is quite common also to install waste heat boilers to recover heat not taken up in the chequered brickworks. The provision of this heat recovery equipment does much to reduce grit emission from Open Hearth furnaces and the pollution problem is mainly one of a fume emission of iron oxide. The particles of oxide in the fume are so finely divided that only highly efficient arrestment such as electrostatic precipitation would be effective. Again, the volume of gas to be treated is so large that the cost of such equipment is such that only a few furnaces have been so equipped as an experiment in the U.S.A.

Other furnaces used in steel making for special purposes include electric arc furnaces, rotary furnaces and air furnaces. Of these only electric art furnaces are numerous in Scotland. The usual electric arc furnace is small by comparison with an Open Hearth furnace, having generally less than one-tenth of the production capacity. The raw material for the furnaces is normally steel scrap. Since the heat is generated by the passage of a large current of electricity in the form of an arc, there are no combustion gases. Nevertheless the heat of the furnaces cause some indraw of air at the charging doors and this air carries iron oxide fume out at the top of the furnaces.

While this emission is often more of a problem within the melting shop than out of it, the general and continuous trend towards improved working conditions is leading to extraction of the fume direct to the air and some measures will be required to minimize air pollution.

The major problem of the steel industry may well be to come with the current trend towards using oxygen gas to speed up the refining process. The injection of oxygen gas into molten steel removes carbon rapidly by combustion and oxidizes silicon for absorption in the molten slag. The injection of oxygen intensifies the density of the fume emission. Indeed the intense orange brown emission is an impressive sight and it is going to be quite a problem to reduce.

Electricity Generation

Electricity generation stations were included in the works scheduled under the Alkali Act on account of their technical complexity. Stations of around 1,000 m.w. per hour capacity (say 1 million 1-bar electric fires) are planned for the United Kingdom and indeed construction has started. In Scotland the generating station at Kincardine has an ultimate design capacity not so very far short. When generating electricity at those rates coal is burned at the rate of more than 5 tons per minute, all in a pulverized form. Electricity stations can burn smokelessly low grade coal unsuitable to most other consumers but low grade coal introduces problems, one of which is the high ash content. Ash amounting to 20 per cent. is quite possible and in large stations burning some 5 tons per minute, one ton of ash per minute would be produced. By the nature of firing with pulverized coal most of the ash is in suspension in the combustion gases. The problem of the electricity industry is to arrest this ash as effectively as possible. Modern electricity generating stations use the method of electrostatic precipitation and the electricity industry has been aiming at higher and higher targets of arrestment as its stations grow in size. Now the aim is 99 per cent. Assuming an overall operating efficiency of 98 per cent., the dust emission from the chimney of a large electricity generating station burning 5 tons per minute of a low grade coal could be reduced from a potential 1 ton per minute to 45 lbs. per minute. Over a day, of course, this emission would not be much short of 3 tons but it is all in the form of a very fine dust which settles very slowly indeed. The amount of plant, trouble and care which is needed to achieve this standard can be gauged only by a visit to a modern electricity power station.

The sulphur dioxide emitted by large electricity generating stations is substantial. The technical problem of reducing this emission is formidable and indeed it is the subject of much technical controversy. As part of their investigation of the problem the electricity generating industry has made very useful contributions to the study of dispersion of gases by high chimneys. Recently they carried out a most interesting aerial survey of the behaviour of gases coming from their high chimneys during a London smog. When the aeroplane established radio contact with the generating stations in the survey, the stations identified themselves by colouring their chimney gases with dyes. The large volume of hot gases from the chimneys were seen from the aeroplane to be punching their way through the smog into the clear air above. It is too early to draw firm conclusions from what is a single set of observations but they are encouraging.

Gas making

Gas is the oldest of the refined fossil fuels and the gas industry has a special part to play in any campaign for clean air, providing two smokeless fuels, gas and coke. Being an old industry divided up into a large number of small units, it has a fairly large proportion of old plants, some of which are prone to produce smoke, grit and dust. For this reason the industry is scheduled, although it is by no means a major source of pollution.

For most of their century-old existence, the Alkali Inspectorate have been in and out of gas works. It is the first time, however, the process of gas making as a whole has been under the Act. Hitherto, it has been ancillary processes which have been scheduled, such as tar dehydration, sulphate of ammonia manufacture, benzol recovery and ammonia liquor manufacture. Basically the gas industry is allied to the chemical industry.

As already mentioned the pollution problems of gas making are not major ones affecting wide areas. Mostly they are localized ones which will decrease with modernization of plants, utilization of by-product gas of other industries and centralization of gas production by putting gas distribution on grids. In Scotland the industry is breaking new ground by installing in Fife a large central high pressure gasification plant for low grade coal which will distribute gas over a wide area of Scotland by means of high pressure mains. There will be no production of coke from this plant.

Coke manufacture

The coke industry is the converse of the gas industry in that its primary product is coke for blast furnaces and other metallurgical purposes. Gas is its secondary product. Compared with the coke of the gas industry, metallurgical coke is physically hard and it is difficult to burn in ordinary domestic fires unless specially treated. Some of the gas produced in making metallurgical coke may be put to use in heating the ovens for coking the coal and in other purposes on the site. Surplus gas is now sold to the gas industry but rather surprisingly it is only in fairly recent times that the last of such surplus gas in Scotland was burned uselessly as a flare.

The pollution problems of the coke industry are more severe than those of the gas industry although they are again localized. The metallurgical coke industry has grown up round the type of plant which carbonizes coal in large batches. Charges of around 20 tons of coal are charged two or three times per hour into hot ovens with an inevitable emission of smoke and at the end of the carbonization period coke is pushed as red hot masses out of the ovens with much dust emission. The red hot coke is water quenched with the evolution of massive clouds of steam carrying grit. Most of the grit falls in the areas of the coke ovens.

The Alkali Inspectorate has had a long connection with ancillary processes in coke ovens and often advised on abatement of the major pollution problems. The industry itself is much concerned with finding a solution to its problems, although it must be doubtful if there could ever be a complete solution with the present method of making metallurgical coke. Before there was any statutory requirement, the largest users of coke ovens in Scotland adopted steps recommended by the Inspectorate on experience gained at other coke ovens. For example, they equipped their coke ovens with double gas collecting mains to reduce smoke emission during coal changing; they converted leaking self-sealing oven doors to clayluted ones; they heightened coke quenching towers; they eliminated an emission of hydrogen sulphide from a water cooling system; and they have taken other steps to the same end of reducing pollution. All of them were complex technical undertakings involving very substantial capital expenditure.

These foregoing problems are among the main ones which the Alkali Order of 1958 brought to the Inspectorate. At the moment we are engaged in a survey of the works which have registered as a result of the Order. At the end of 1958 there were 70 works registered in Scotland and there are now over 300. It will take some time to get down to detail at all the works but some lines of broad policy are being formulated and made known to the industries. For some of the problems there can only be palliatives and for most of them there can be no quick solution. A large measure of co-operation and goodwill is being received both from industry and from local authorities. As in the past much of the brunt of complaints will doubtless continue to be directed at the officials of the Public Health Departments of local authorities, who are on the spot, but they have always brought a great deal of understanding to bear on this particular problem. In the ultimate issue achievement of clean air will depend on a joint effort of the public, industry and those in the local and central government service.

The Alkali Inspectors' Reports

Intensification of Effort

95th Annual Report on Alkali, etc., Works, by the Chief Inspectors, 1958. H.M. Stationery Office, pp. 55. 3s. 6d. net.

THE new Alkali, etc., Works reports—that for England and Wales by Dr. J. S. Carter; for Scotland by Dr. E. A. B. Birse—give the first account of the extension of work and responsibility because of the Clean Air Act, under which the Alkali Act was extended to cover a further eleven classes of works.

As a result, the number of registered works increased from 872 at the end of 1957 to 2,160 at the end of 1958, and the number of separate processes at these works from 1,733 to 3,412.

The extension includes certain processes in iron and steel, copper and aluminium works; power stations, gas and coke works, coal-fired producer gas plant, certain types of oil and coal-fired kilns for manufacturing pottery, bricks and tiles, and coal-burning lime kilns. Some of the new works are very large undertakings, particularly in the iron and steel industry and the newer power stations. The staff of the alkali inspectorate has been increased, and there are now 12 district inspectors instead of seven, and inspectors assisting have been or are to be, appointed.

In dealing with the new works the first task has been to assess the magnitude of the problems and to make plans. The Chief Inspector has had discussions with the appropriate industrial associations to examine problems, to stress matters of greatest urgency, and to agree to a future policy of research and measurement. Where necessary working parties have been set up to investigate problems of special difficulty. Decisions reached at these meetings were communicated to the constituent members of the industry and to the district alkali inspectors so that they can be put into effect.

Iron and Steel

The report deals at some length with the air pollution problems posed by the iron and steel industry, perhaps the most difficult of all the new tasks facing the inspectorate. Not only are there very large works with areas measured in square miles and responsible for appreciable pollution, but there are also furnaces at smaller works likely to cause complaint since many of these works are surrounded by houses. There is a need, says the report, for co-ordinated research, pilot scale and full-scale experiments, before a solution to many of the problems is in sight. For many of these, broad decisions at national level applying to the whole industry may well be necessary.

Power Stations

There were 206 power stations registered under the Act, and they burnt 43 millions tons of coal in 1958. There are big new stations fired by pulverized fuel fitted with electrical precipitators and cyclones for arresting dust whose gases are discharged to the air by high chimneys. The best time to solve the major emission problems of these works is at the design stage, and this is being done. Chimney heights of up to 550 feet are planned. A good deal of complaint relates, however, to the very small power stations with old boiler plants of small capacity and limited life, used only for peak loads. Few are fitted with modern grit arresters, and chimneys are often low. Instrumentation may be lacking to secure efficient combustion. Many are sited in built-up areas and great care is needed in operation.

Gas Industry

The gas industry is concentrating its production. Many small works are likely to close down soon. Elimination of smoke from their old horizontal retorts is an almost intractable problem. Continuous vertical retorts at modern gas works present fewer difficulties. Good carbonization coals are getting scarcer, and processes to use poor quality coals, or products from the petroleum industry, have been introduced. The inspectorate, in cooperation with the industry and designers, is doing its best to solve the new air pollution problems they present.

Pottery Works

The report mentions the very great strides made in reducing smoke from pottery works in Stoke-on-Trent, and states what further steps are to be taken to convert or replace the traditional coal-fired bottle kilns. Twenty-five years ago pottery firing was carried out almost entirely in bottle kilns, which are virtually incapable of smokeless operation, and which used about 1,250,000 tons of coal annually. The introduction of gas, oil or electrically fired tunnel kilns has led to such a vast change that the use of coal in the Stoke-on-Trent region for firing pottery is now probably below 250,000 tons a year.

As regards control under the Alkali Act of processes registered before 1958, steady and sometimes notable progress continues to be made. The report mentions the major reconstruction of the Bevan Cement Works on Thames-side with electrical precipitators and a new high chimney, the checking of acid mist by electrical precipitators at sulphuric acid works, the treatment of gases from rayon manufacture, and the installation of further units at oil refineries for removing sulphur from refinery gases.

Assistance has been given to local authorities in dealing with works not controlled under the Alkali Act. The report mentions in particular the measures taken to deal with the offensive " cat smell " and " fish smell " on Tees-side, and another " cat smell " in North Staffordshire. There have been no further complaints of the Tees-side " cat smell," and the final scheme for the chlorination of the effluent is expected to be working in 1959. A scheme for curing the " fish smell " was almost ready to operate by the end of the year.

Nuclear Power

The Chief Inspector reports on visits paid to establishments of the United Kingdom Atomic Energy Authority to ensure that discharges to the air are regulated to prevent any danger to public health. The evidence obtained established that the discharge of gaseous effluents from these works had been satisfactorily controlled. The consequences of the nuclear power programme, particularly as regards the processing of uranium for fuel and the disposal of irradiated uranium, were also considered. Consultations with the Central Electricity Generating Board also took place on the safe operation of the nuclear power stations.

Complaints

Complaints were investigated at 270 works compared with 133 in 1957. Of the 207 complaints against registered works, 140 related to those which have become registerable since last June. Complaints were most numerous against ceramic works (43), gas and coke works (36), electric power stations (27), iron and steel works (20), aluminium works (13) and cement works (13).

Scotland

The annual report of the Chief Alkali Inspector for Scotland (Dr. E. A. B. Birse) tells a similar story of greatly increased responsibilities. In Scotland the Clean Air Act came into full operation on December 31st, 1958, and 18 additional classes of works became registerable in Scotland under the Alkali Acts at that date. The number of registered works increased on December 31st from 70 to 169. An additional inspector took office during the year.

The Scottish report deals with visits to a number of different types of alkali works. During the year 213 visits of inspection were made by the Scottish inspectorate and six complaints were received against registered works, three of these relating to premises where the granulation of fertilizers was carried out. As in England and Wales, assistance has been given to local authorities in dealing with works not controlled under the Alkali Acts. For example, the Scottish inspectorate assisted in dealing with troublesome fumes from a refinery for scrap aluminium, and with an emission of mineral wool from the exhaust stack of a factory.

Carnival at Fulham.—*A display featuring Clean Air and making good use of one of the Society's new posters—the popular "little man" with the slogan "Clean Air is Your Affair"*

Air Pollution and Cancer

RECENT PAPERS

TWO papers of great interest have recently been published, both of which deal in whole or in part with the relationship between air pollution and cancer. The first of these papers, entitled " Cancer and its Cause,"* is by Professor F. C. Pybus, Emeritus Professor of Surgery, University of Durham. The second is a report of the Seventh International Cancer Congress, held in London in July 1958,† by Arnold E. Reif, Tufts University School of Medicine, Boston.

Professor Pybus, in his paper, sets out his hypothesis that the cancer-forming agents in smoke are in fact the main cause of the disease. He says that in reviewing fifty years clinical experience of cancer in man and animals, and thirty of personal research, he had reached the conclusion that 90 per cent. of the disease was due to the benzpyrene or other cancer-causing agents in the smoke contaminated atmosphere. Further evidence had done much to confirm what he calls a mundane and prosaic explanation—that the general cause of cancer was man made, that it was in effect a dirt disease, and therefore there is great hope of prevention.

Professor Pybus reminds us of the famous discovery by the eighteenth century medical man, Pott, of the part played by soot in the causation of cancer. He points out that benzpyrene, one of the most virulent of cancer stimulating agents, is widely found in tar and smoke from domestic and industrial premises. The amount of benzpyrene from coal, he contends, amounts to 1·5 grammes per person yearly.

Professor Pybus points out that we are all exposed to the fumes of tobacco from early youth; nevertheless, he does not think that tobacco is a major cause of cancer, even of the lung. He gives as his reasons for this view that many human beings die of lung cancer who smoke very little, or not at all, and also because it occurs frequently in some strains of laboratory animals who have never come into contact with tobacco smoke.

Criticism, based on the antiquity of the disease, which was known to the Greeks, he answers by pointing out that man has used and lived with fire and smoke from time immemorial. He says that it might be said that " when man discovered fire and learned to use it he doomed himself and his posterity to the possibilities of cancer." He points out that men now have to contend with vehicle fumes which contain benzpyrene. He also considers that his theory meets objections based on the tendency of the old to develop the disease rather than the young, since it would need a considerable number of years for a person to acquire a sufficient dose. Again, cancer is known to manifest itself after a long period of latency, as in the case he quotes of the man who had been at sea for twenty years before he developed cancer; he had been a sweep for twenty years before becoming a seaman. That all people exposed to smoke do not acquire cancer, he ascribes to differences in susceptibility.

Speaking of education of the public, Professor Pybus says that doctors should teach their patients not to produce unnecessary smoke, to avoid it and to demand its suppression by their local authorities—" in other words carrying out the purposes of the Clean Air Act." Doctors should also try to educate local authorities themselves wherever feasible.

Among Professor Pybus's conclusions are: that Britain is said to be the smokiest country in the world, that everything is contaminated by smoke and soot, that estimates of benzpyrene show that most persons could get an " effective " (*i.e.*, lethal) dose, and that domestic smoke causes carcinoma in animal experiments. " Man," he says, " has conducted a long-term experiment on himself by living in a smoky atmosphere and seeing who would get cancer." Also: " Those who produce smoke; individuals, public and local authorities, State Institutions and Boards, are guilty of an anti-social act and are, indeed, public enemies."

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* Medical Press, **241,** Nos. 6 & 7, pp. 122-126, 149-154. Feb. 11 & 18, 1959.

† Science, **128,** No. 3337, pp. 1512-1522. Dec. 12, 1958.

The Seventh Cancer Conference

The review of the Seventh Cancer Congress by Mr. Rief covers a much wider field than the paper by Professor Pybus, for it describes papers on many possible causes, methods of diagnosis, and treatments. The only papers which mention air pollution are those devoted to the causation of lung cancer. It is, however, of special importance, as lung cancer is the only type of cancer whose incidence has rapidly increased in recent years. Much more emphasis was laid, in the papers given at the Congress, on the importance of cigarette smoking as a causative factor. Several authorities claimed to have shown that the difference in incidence between men and women could be accounted for by the degree of cigarette smoking. W. C. Hueper, of the U.S. Department of Public Health disagreed; he laid more emphasis on atmospheric pollution as a cause.

R. E. Waller reported that there is a 2:1 ratio in over-all mortality from lung cancer in large towns as compared with rural areas in Britain. He thought that this was partly temporary and reflected a later onset of cigarette smoking in rural areas. P. Stocks, however, indicated clearly that the relatively heavy atmospheric pollution in certain British cities was a major factor responsible for this urban-rural difference.

Mr. Rief reports a symposium on lung cancer held during the Congress, at which data by E. C. Hammond was quoted which show that the lung cancer death rate in large American cities is five-fourths of that in rural areas. Also the urban non-smoker should have one-fourth the lung cancer death rate of the average cigarette smoker, and this fits Hammond's figures. His data shows that the lung-cancer rate for non-smokers in rural areas is very low, about one-thirtieth that of smokers.

Further experimental evidence on air pollution was given by W. C. Hueper, who cited several kinds of industrial dusts, as well as the combustion products from coal, wood and petrol, as cancer causing agents. From these data and other statistical evidence he concluded that atmospheric pollution is a more important factor than smoking as a source of lung cancer. Other authorities mentioning the part played by air pollution were P. Kotin of Los Angeles and L. M. Shabod of Moscow. The former concluded from laboratory studies that the environmental cancer causing agents responsible for lung cancer include polluted atmosphere, infectious agents, and cigarette smoke. The latter reported that atmospheric pollution may be one of the causes of lung cancer, and that use of advanced fuel-burning systems and rational town planning can decrease or prevent atmospheric pollution by 3:4 benzpyrene.

According to Mr. Rief, the papers presented established decisively that cigarette smoking is *a* cause of lung cancer, and, beyond reasonable doubt, that cigarette smoking is the *main* cause of the present increase in lung cancer incidence. After smoking, atmospheric pollution emerged as the most significant cause of cancer. " Epidemiological reports suggested that its effect is smaller but certainly not negligible, even relative to the powerful effect of habitual cigarette smoking; that, for non-smokers, the incidence rate of lung cancer is very small in rural areas; and that atmospheric pollution greatly increases this rate."

Epidemiology of Cancer

Since the review above, *Air Pollution and Cancer*, was written, another interesting survey of cancer has been published in the *Practitioner*. This is written by Dr. Percy Stocks, under the title *Epidemiology of Cancer*. After discussing the merits of epidemiology (which he defines as " the science which deals with mass phenomena of disease in mankind "), Dr. Stocks reviews the statistical evidence relating to the incidence of cancer in various sites of the body. Among the points he mentions is that there is a significant connection between air pollution and stomach cancer in large towns and the two northern counties.

Turning to lung cancer he points out that the extent to which this disease has increased during the last twenty years can only partly be explained by improved recognition of the disease.

More than twenty investigations in eight countries, comparing past smoking habits of men with lung cancer with those of control groups, have shown a larger proportion of heavy smokers among the former, three large-scale studies indicate strong correlations between incidence of the disease and the number of cigarettes habitually smoked by each sex, says Dr. Stocks. He concludes that cigarettes smoking is the chief cause of lung cancer, but atmospheric pollution is a major cause. Death rates from lung cancer in the large towns of England and Wales are highly correlated with the amounts of atmospheric deposit and smoke and this correlation remains after allowing for differences in population density which may affect the rates in other ways. This is true also for all districts of Lancashire and the West Riding of Yorkshire for which air pollution data are available, and a statistical association is found between death rates and the population density of adjacent areas independently of the density in the district itself, phenomena which are found also for bronchitis and seem to point unmistakably to drifting smoke as the urban factor. In Liverpool and North Wales region the concentration of benzpyrene and other carcinogenic hydrocarbons in the air agree tolerably well with lung cancer death rates in districts surrounding the points of measurement.

Dr. Stocks ends his paper by saying " In my opinion the inescapable answer to all this is that in face of the rapidly rising mortality from lung cancer and the strength of the evidence jointly incriminating cigarette and atmospheric smoke, everything possible should be done to remove or prevent the production of carcinogens already known to be present, to educate people as to the risks and discourage boys and girls from acquiring the cigarette habit, and to reduce pollution of the air in towns by potentially carcinogenic substances."

A.P. from Smokeless Fuel Plants

Chesterfield R.C. have complained to the Ministry of Housing and Local Government, that air pollution around the Coal Board's coke ovens at Grassmoor has worsened since the Board started to manufacture smokeless fuel.

A.P. and an O.A.P.

Mrs. Alice Barton, a 72-year-old pensioner, was the first person to apply to the Sheffield City Health Department for the installation of a smokeless grate, in the city's first smoke control area.

CLEAN AIR ACT CASES

Smoke from Household Chimneys in Smoke Control Area

The first cases to be heard in West Bromwich under Section 11 of the Clean Air Act 1956 were before the Stipendiary Magistrate (Mr. Kenneth Wood) on Monday, May 25th. A written plea of " Guilty " was entered in each case though the Defendants were neither present nor represented. After hearing all the evidence Leonard Parsons of Edward Street was fined three pounds and his father, Enox Parsons (81) of Edward Street was fined one pound.

Referring to the elder defendant, the Stipendiary Magistrate said he had considerable sympathy with old people who would now have to try to keep warm in the unpleasant winters we all had to suffer with a fuel which, rightly or wrongly, they might not consider as comfortable or as warming as the coal to which they had been accustomed all their lives.

" I do not want it to be thought, however, that by my leniency I am belittling the importance of a very essential measure to ensure clean air " he said. " The Order must be strictly complied with. It is a beneficial Act."

For the Corporation the Deputy Town Clerk, (Mr. E. Thomas, LL.B.) said there had been every possible endeavour to persuade, advise and encourage co-operation on the part of householders and in most cases this had been successful. It was now felt that after seven months the limit had been reached and the Corporation must insist on compliance with the Order.

Both defendants refused the public health inspectors admission to their houses to see the fires so that they were forced to rely on a description of the smoke from the chimneys being similar to coal smoke and not likely to be from an " approved fuel." Samples of these were exhibited in the Court as well as a large scale map and photographs to assist in the identification of the houses and chimneys concerned.

The Stipendiary attached much importance to the evidence as to the possibility of smoke being emitted from " fines " derived from broken Coalite or coke in a wet or damp state. This arose from a statement in a letter from one of the defendants. The duration of the emissions, in these cases ten minutes, and the density and colour of the smoke was therefore important.

It was considered by the public health inspectors concerned that longer observations would have been advantageous.

Section 1.—Stockport

Hazeldine Ltd. were fined £5 by the Stockport magistrates on Tuesday, June 2nd for emitting dark smoke for 45 seconds more than the permitted period.

Section 1—Leamington's First Smoke Prosecution

In view of the " very complicated regulations," the magistrates awarded a nominal fine of £5 in a case brought against the Holly House Laundry Ltd. Mr. F. C. Hill, Leamington's Deputy Chief Public Health Inspector, stated that although the laundry had an automatic stoker, insufficient care was exercised by the person in charge.

Section 1.—Preston firm's £20 Fine

Horrockses, Spinners and Manufacturers Ltd. were fined £20 on May 29th for a dark smoke emission of 41 minutes on the morning of April 3rd. The prosecution stated that the decision to bring the matter to court followed a number of observations.

Every Right to Complain About Smoke

British Railways have confirmed that anyone has the right to complain about smoke from the Commission's locomotives. This follows a protest by Mrs. F. Aherne that she was told to leave the Camden Motive Power Depot when she had gone there to complain about the smoke. She was told that she had no right to be there.

Section 1—First Willenhall Prosecution

Two men were discharged on condition that they conform to the law in future, at Willenhall Magistrate's Court, July 6th, where they faced a charge of causing a smoke emission by burning coal in Willenhall's Number 1 Smoke Control Area.

Section 1—Bakery Fined £10 at Wimbledon

A. & B. Hemmings Ltd. were fined £10 at Wimbledon on July 8th following a continuous emission of black smoke from their bakery in Morden.

Section 1—Rotherham's First Case

The Rotherham Forge and Rolling Mills Co. Ltd. were fined £1 in respect of each of four offences, with 10 guineas costs.

Section 1—Birmingham

On June 26th a Birmingham brickworks was fined £10 for the emission of smoke in contravention of Section 1 of the Clean Air Act. The defendants pleaded not guilty to a summons alleging two emissions of black smoke totalling six minutes in the aggregate during a period of thirty minutes, from a chimney serving one Lancashire boiler (hand-fired) and one brick kiln.

Section 11—Birmingham Smoke Control Area

At Birmingham on July 3rd a firm of motor car retailers, whose premises are in a smoke control area, were fined £10 for an emission of smoke in contravention of Section 11 of the Clean Air Act. The summons alleged emission of dense smoke for 12 minutes duration from a chimney of the building serving a large heating boiler. It was stated in evidence that the smoke appeared to be due to the burning of a quantity of trade refuse, including oily sawdust.

Section 1—Nottingham's First Case

Smoke from a boiler taken from a German tanker in the first world war led to a case at the Guildhall in which Tidmas Factory Ltd. were fined £12. The defence said that on the day the recordings were taken by the health department, the stoker who had looked after the boiler for the past 30 years was away ill, and his brother had taken over.

Section 20—Shipowners Fined for Smoke Emission off Gravesend

The Charente Steam Ship Company Ltd., Liverpool pleaded guilty at Grays, Essex and were fined £10 because their vessel *Successor*, emitted dark smoke for four times longer than the permitted period under the Clean Air Act on January 23rd.

Proof in the Pot

G. A. Hiller, C.P.H.I. for Leicester, and new Chairman of the Society's East Midlands Division, at a recent exhibition examining the thick soot deposit on the inside of a chimney pot

FUEL ECONOMY AT COLLIERIES

National Coal Board Students Will Set Higher Standards of Efficiency

More than 1,000 students have now passed City and Guilds examinations in fuel efficiency under a novel system of training set up by the National Coal Board seven years ago: 905 have received the Boiler Operator's Certificate; 83 the Intermediate Grade Certificate in Boilerhouse Practice; 30 the Final Grade in Boilerhouse Practice, and four have passed the examinations in Combustion Engineering.

Training for the Boiler Operator's Certificate was devised so that men on shift work could take full advantage of it, and the course consists of seven months home study through weekly correspondence and one full day a month in which the students discuss their theoretical work and do practical demonstration under the supervision of a trained engineer. The correspondence course is arranged through the College of Fuel Technology and the practical work is supervised by the Board engineers; the examination is open for boiler operators and chargemen who have had 1,000 hours firing experience.

When this primary course became established students were in turn introduced to the Intermediate Grade Boilerhouse Practice Course which covers more advanced theoretical knowledge of different types of boiler plant, and later to the Final Grade designed for chemists, engineers and for boilerhouse foremen who have won high marks in the Intermediate examination.

The Combustion Engineering Course is at a high educational level and is intended for engineers and chemists and others concerned with the testing of combustion equipment, but it is also open to students with a first class pass in the Final Grade Boilerhouse Practice.

The amount of coal burnt in colliery boilers is being reduced each year but it is still high, (6·6 million tons being consumed in 1958), and substantial economies can be achieved by efficient stoking. A recent Order under the Clean Air Act makes it clear that mechanically fired coal-burning furnaces are permitted in smoke control areas but only if efficiently fired. Thus high standards in the boilerhouse are ever more widely needed.

Greek Ship Sets Poser for Hull Smoke Control Area

Port Health inspectors and engineers have been trying to prevent a Greek ship in King George Dock spreading clouds of black smoke across Greatfield Estate—one of the three smoke control areas established in Hull on June 1st.

" The ship arrived in Hull on June 11th and has been blowing out black smoke more or less ever since," said Dr. Alexander Hutchison, Port Medical Officer of Health.

" We have been trying to remedy it, but without much success."

The vessel is the 5,032-ton *Kapetan Kostis*, owned by the Compania Naviera Palma SA, and registered at Pireaus.

In Section 70 of the memorandum on the industrial provisions of the 1958 Clean Air Act, local authorities are advised that no action should be taken against foreign vessels calling at a port for the first time since the establishment of smoke control areas.

A port health official said the smoke was produced by an auxiliary oil-fired boiler working the vessel's winches.

The ship's Hull agents told the *Hull Daily Mail*, " The owners called in local engineers to try to do something about it but so far it has not been possible."—*Hull Daily Mail.*

The Latest Publications

Stoker's Manual—Air Pollution Control—Solid Fuel Appliances

New Stoker's Manual. National Industrial Fuel Efficiency Service, London, pp. 104. 2s. 6d.

The original *Stoker's Manual*, prepared and published by the old Fuel Efficiency Committee of the Ministry of Fuel and Power during, or just after, the war, was a tremendous help to those engaged in the training of boilermen. It did yeoman service, and has now been replaced by a new version, issued by N.I.F.E.S.

It will be of much help to the unqualified boilerman who wishes to know more about the why and wherefore of his job; and for the man who intends to obtain the Boiler Operator's Certificate it will serve as a first-class introductory text-book. The book is written in straight simple language. It starts by discussing the operation of hand-fired boilers, and goes on to describe grates and firebars, air supply and control, and the various types of mechanical stoker.

There is then a chapter on "How Coal is Described," and another on the principles of combustion. Further short chapters are concerned with explaining the different kinds of boiler, with oil firing, the operation of central heating boilers, and safety factors. Finally, there is a short explanation of the Clean Air Act, what is meant by dark smoke, and so on.

As an example of the easy style of the book we may quote from the paragraph on smoke:

"Everyone knows that smoke is made up of many small particles of carbon which have escaped from the fire without being burnt. So the presence of smoke shows that the fuel has not been properly burnt and that some of the heat has been wasted. In Chapter VI you were told that a certain amount of air is needed to burn the fuel. If you allow less than this you will get smoke. If you allow too much you will get a perfectly clear stack, which is bad from the point of view of combustion. What you should aim at is just a light haze coming from the top of the stack, which shows that there is neither too much nor too little air."

Although naturally intended for stokers, we can recommend the Manual to all public health inspectors, medical officers and others who wish to gain a broad understanding of the principles and practice of boilerhouse work.

Air Pollution Control, by W. L. Faith. John Wiley & Sons, Inc., New York and Chapman & Hall Ltd., London. pp. 259. 68s. net.

W. L. Faith is the Managing Director of the Air Pollution Foundation at San Marino, California. He has written a practical and workmanlike text-book, which, although written from the American viewpoint, and more specifically from the West Coast viewpoint, nevertheless contains a great deal of well-presented information that will be of value to workers and students in Great Britain.

Divergence from the British approach is perhaps most noticeable in the first chapter, where the problem is surveyed generally. Emphasis is given to notable air pollution "episodes," rather than to the "chronic" conditions which are our greater problem, and we would differ from the author when he says that London did little about it until the famous smog of 1952. A great deal, even if not enough, had been done before then, and, for instance, the development of the smokeless zone principle was well under way before 1952.

A difference in terminology in the U.S.A. and Britain, which should be noted to avoid future difficulties, is shown by the following quotation:

> "The public has chosen the word *smog* to define objectionable air pollution. Originally the word was a contraction of *smoke* and *fog*, but recently it has become descriptive of any air pollution event accompanied by a decrease in visibility. In some cases it has been used to describe malodorous or vegetation-damaging conditions where visibility was no problem. To all intents and purposes, then, the words *smog* and *air pollution* may be considered synonymous."

Will this broadening of the meaning of "smog" spread to this country, or will we continue to confine it to its useful original meaning of smoke-fog?

After the introductory chapter, and one on the meteorological aspects of the problem, Mr. Faith deals separately with smoke; dusts, fumes and mists; gases; odours; and automobile exhaust. The remaining chapters are on the air pollution survey and the legal aspects.

The technical chapters are excellent, both in their clear presentation and their comprehensiveness. To sum up, this is one of the best text-books from America that we have seen, and should be on every up-to-date air pollution bookshelf.

Approved Domestic Solid Fuel Appliances, 1959. Coal Utilization Council and Solid Smokeless Fuels Federation, pp. 78.

This revised handbook, dated February 1959, cancels the 1958 list. It has been published in a smaller, and handier format. Nearly 200 appliances, made by nearly 80 manufacturers, are listed, and essential technical data on each is given. Except for the larger appliances, nearly all those listed have been recommended by the Ministry of Power for local authority and equivalent housing.

B.C.U.R.A. Annual Report, 1958. British Coal Utilization Research Association, Leatherhead. pp. 60.

This report, as usual, contains a great deal of direct interest to those concerned with the smokeless use of coal in industry—and even, possibly, in the home—as well as much on improving efficiency in ways that will indirectly reduce air pollution. There is also a list of the considerable number of reports and papers published by the Association, or members of its staff, during the year.

Mention may be made of the work being done on the improved use of small coal (below ½ in.), an air-fuel ratio controller, and the measurement of grit and dust emission from stacks. On the domestic side, references are made to the automatic domestic stoker for central heating in large buildings, and to a novel solution to the problem of automatic control of the small chain-grate stoker. The load on the boiler (which may vary by a factor of 10 to 1) controls the rate of coal feed to the grate so as to maintain the required boiler outlet temperature; a detecting device at the rear end of the grate then regulates a series of undergrate dampers, which distribute the primary air along the grate to ensure complete combustion without unwanted excess air. Patent applications have been made for the new features, and prototype stokers have been constructed in the Association's workshops. Tests using ½ in.—0 coal smalls have shown virtually smokeless combustion and high efficiency over the whole range of heating loads, and further developments are in progress.

A novel method of achieving smokeless combustion of bituminous coal in a closed appliance is being studied; this is based on a simple and automatic method of feeding small quantities of coal at a time, and the use of forced draught. An attempt is being made to develop on this principle an automatic smokeless boiler, capable of using quite small sizes of coal, and suitable for use with the small-pipe central heating system.

Sulphur

Work has continued, under contract with the Ministry of Power, on sulphur release from domestic appliances; both he possibility of preparing sulphur-etaining fuels and the mode of sulphur elease have been further studied.

The investigations into the properties of soda-impregnated cokes and low-emperature carbonized fuels has been ompleted. The effect of the soda reatment varied widely with the type f fuel and with the burning rate; in he most favourable case a treated semi-coke burning at a low rate etained over 70 per cent. of the fuel sulphur in its ash.

The treatment is thus reasonably effective, continues the report, and there is a significant improvement in reactivity which might in part offset the disadvantages of adding mineral matter. But the ash content is raised by 4–5 per cent., and the fuel must be kept under cover to avoid leaching. The effect on clinkering in closed appliances remains to be studied.

The mode of release of sulphur from a typical house coal has been studied in detail using the open fire installation with induced draught, described in 1957. Coal size and burning rate were varied over wide limits and the tests covered most typical domestic conditions including banking and light-up from cold. It has been found that surprisingly large amounts of hydrogen sulphide are evolved, particularly after refuelling. The amount produced varies greatly and is dependent upon several factors, notably the state of the fuel bed, the burning rate and the coal size. On the total balance, hydrogen sulphide may contribute 5 to 25 per cent. of the sulphur release. Further work is in progress to identify the conditions required for the maximum and minimum contributions.

B.I.S.R.A. Annual Report, 1958. British Iron and Steel Research Association, London, pp. 154.

Among other reports we have received, this will be of especial interest to those of our members concerned with air pollution from iron and steel processes. Directly on air pollution is a reference to the testing of a new apparatus, " LISA " for the gravimetric measurement of dust and fume content in gases from iron and steelworks plant. The tests have shown that the apparatus gives reliable gravimetric measurements of the amounts of dust and iron oxide fume in flue gases and is convenient to operate under steelworks conditions. The apparatus is now being manufactured by the Longworth Scientific Instrument Company.

In collaboration with member companies and the Air and River Pollution Committee of the British Iron and Steel Federation, trials are being arranged to establish simple methods for continuously monitoring the emission of solids from chimneys. The use of photo-electric smoke-density meters for indicating emission of iron-oxide fume is first being investigated.

Experiments have been continued on a laboratory pilot plant to find a method for cleaning gases containing iron oxide fume without incurring high capital or running costs. Various forms of fume-cleaning systems of the wet scrubber type have been studied.

Experiments on a Pease Anthony venturi type of wet scrubber have shown that when water is injected at right angles to the gas stream near the throat of the venturi fume-collection efficiencies of up to 95 per cent. can be obtained. An alternative to the venturi tube scrubber section has been developed in which a straight tube is used and a water spray is injected concurrently with the gas stream. Efficiencies of up to 97·5 per cent. have been obtained with this system. The building of a wet scrubber of this new type is being considered in collaboration with a plant manufacturer to clean the outlet gases from the pilot plant at the Association's North-east Coast Laboratories.

Some continental installations for collecting and cleaning the waste gases from bottom-blown converters have been examined. In two installations cyclones operating under chimney draught collect and remove all entrained particles greater than about 100 mu. in diameter. At another plant a system has been designed which will recover the sensible heat and calorific value of the furnace gases and then deliver them to an electrostatic precipitator for fine cleaning. It is apparent, says the report, that in these plants considerable progress has been made in the development and use of systems for collecting flue-dust from steelmaking furnaces.

Two Giant Dust Collectors

Two contracts, involving multi-million-dollar programmes to control air pollution by open hearth furnace gases, one at a major steel plant in the United States and the other at a similar plant in Italy, have been awarded to Koppers Company Inc., Technical Associates of the well-known British firm of W. C. Holmes & Co. Ltd.

One contract calls for installation of seven Koppers' electrostatic precipitators at the Pittsburgh works of the Jones & Laughlin Steel Corporation. The other will provide four precipitators at the plant of Cornigliano, S.p.A., in the suburbs of Genoa. Considerable significance attaches to the latter contract from the fact that it will be the first such installation in Europe. The Jones & Laughlin contract, however, is of major importance, since it will provide dust control for the open hearth furnace chimneys of one of the largest steel works in a city that has waged a world famous campaign against air pollution.

In announcing his company's plans, Walter H. Lewis, Works Manager for Jones & Laughlin, said: " We are making every effort to comply with the programme of the Air Pollution Control Bureau of the Allegheny County, Pa., Department of Health. We believe the installation of the new precipitators will be a long stop in the right direction. We are certain that our new units will contribute materially to Pittsburgh's programme for a cleaner atmosphere." Similarly, officials of the Cornigliano plant have declared that their purchase of the Koppers equipment was prompted by a desire to clear up an air pollution problem that has plagued both them and Genoa residents for some time. That problem has been made more acute recently with the establishment of Genoa's new airport on land immediately adjoining the steel plant.

The Cupola Problem—Dust and grit emissions from cupolas have been a serious problem in districts where cupola operations are carried on, and they have proved to be one of the most intractable of all pollution problems. W. C. Holmes & Co. Ltd. (Gas Cleaning Division), of Turnbridge, Huddersfield, have recently issued an illustrated brochure on the " Holmes—Schneible S.W." cupola collector which will be of interest to all who are concerned with this problem. This uses a water curtain for entraining the solid particles. It consists of an outer shell and collection trough supported on an angle ring welded to the cupola stack. A deflector cone is supported from the collector shell in such a way that the cupola gases are confined to an annular passage between the edge of the cone and the collector shell.

A patented distribution head distributes the water equally over the surface of the cone without the use of sprays. This distribution head is non-clogging and will pass any solids pumped to it; it is adjustable and can be readily opened for cleaning or inspection purposes. The water leaves the circumference of the cone and forms a heavy water curtain through which the gases have to pass causing the ash and cupola grits to be retained. The water and collected solids impinge upon and run down the inside of the collector casing into a collection trough. This trough is self-draining and is provided with an outlet from which the water and solids discharge to the recirculating tank.

£350 Prize for Armless Inventor

Working with artificial hands, M. Max Surruys, a French scientist who lost both arms in an explosion, has invented a device for reducing fumes from car exhausts with a 10 per cent. saving on fuel consumption. For his efforts he has been awarded a £350 prize.

AIR POLLUTION ABSTRACTS

339. The Occurrence of Sulphur in British Coals. Wandless, A. M. (J. Inst. F. **32,** 258–266, June, 1959). This paper is intended to provide a factual background of the occurrence of sulphur in British coals. The origin of sulphur in its various forms is briefly discussed and the average contributions of organic and pyritic sulphur to the total sulphur content of coal seams are worked out. A statistical study is made of the average sulphur content of the seams at present worked in all coalfields; the trend of increasing sulphur content in recent years is analyzed and future prospects are briefly outlined. Attention is drawn to important variations of sulphur content with coal rank, and the paper concludes with brief notes on sulphur in foreign coals and in British crude-oil supplies.

340. Operating Characteristics of Boilers in Relation to Steam Demand. Ritchie, E. G. (J. Inst. F. **32**, 314–316, July, 1959). The paper postulates that the most important factor in industrial steam plant, so far as smoke and grit emission are concerned, is the attempt to follow a fluctuating steam demand by varying the rate of firing. This results in waste of fuel in the boiler-house owing to inefficient combustion, and loss of output of finished product in the factory, owing to variation in steam pressure. Thus, in a double sense, the fuel consumed per ton of product is increased. Different established methods of storing thermal energy in industry are discussed as a means of obtaining maximum efficiency where the steam demand varies, and reference is made to the thermal-storage boiler, which is finding a wide field of application in dyeworks, food factories, breweries, chemical works, printing works and in the millboard and plastic industries. The use of the thermal-storage principle in one form or another for the stabilization of firing rate and steam pressure, independent of demand, offers substantial possibilities of reducing the fuel consumption in industry, and eliminating excessive smoke and grit emission.

341. The Effect of Probe Shape on the Accuracy of Sampling Flue Gases for Dust Content. Whiteley, A. B. and Reed, L. E. (J. Inst. F. **32,** 316–320, July, 1959). Tests have been carried out in order to develop probes for dust sampling that would be more robust and compact than those normally employed. Several probes of different shapes were tested and of these two " non-standard " types were considered sufficiently promising to warrant further investigation. These were tested over a wide range of sampling velocities using a relatively coarse test dust and their performance was compared with that of the " standard probe " under comparable conditions. It was found in all cases that the weight of dust collected by the probes was almost independent of the sampling rate.

342. The Preparation of Smokeless Fuels for Domestic Use. O'Connor, J. G. (Sheffield Univ. Fuel Soc. J. **9,** 9–16, 1958). Existing knowledge is reviewed. The carbonization of coal heated by combined radiation and conduction and also by a hot inert gas was studied experimentally. (B.C.U.R.A.).

343. Coal as a Smokeless Fuel. Cellan-Jones, G. (Gas World, **149,** 345–346, 348, (Feb. 14) 1959). It is reported that small bore-holes, ¼ in. to ⅛ in. in diameter, can be drilled quickly and neatly in coal lumps larger than 2 in. by means of needles heated to 750° C. or above. It is claimed that lumps traversed by a suitable number of such bore-holes will burn smokelessly on the domestic open grate. (B.C.U.R.A.).

344. Chimneys and the Clean Air Act. Evans, P. A. (Fuel Econ. Rev. **37,** 67–70, 1959). A discussion is presented of the technical factors involved in the design of a chimney as they are affected by the Act. (B.C.U.R.A.).

345. Motor Industry Research

Association; Thirteenth Annual Report. (July 1st, 1957 to June 30th, 1958. Lindley: The Council of M.I.R.A., Oct. 1958, 35 pp.). Included in the Research Report is an account of the work of the Advisory Panel on Atmospheric Pollution. The Panel has met on several occasions and, in particular, has studied the performance of exhaust smoke-meters. This co-operative effort has now led to the unanimous adoption of a particular meter for laboratory use, and its possibilities as a measuring instrument for complete vehicles are being examined by several of the Panel members. Objective measurement of exhaust smoke and correlation of the laboratory work of different investigators is now possible.

346. Exposure to Low Concentrations of Air Pollution. 3. Chronic Bronchitis in Relation to Air Pollution in Great Britain. Carey, G. C. (Washington: U.S. Govt. Print. Off., 1959, Publ. Hlth. Serv. Publ. 654, " Proceedings: National Conference on Air Pollution, Nov. 1958," 203–207). Review of air pollution studies in relation to chronic bronchitis in Great Britain, where 200 million tons of soft coal are burned per annum; comparative statistics with other countries; extrapolation of the problem to the United States where 60 per cent. of the conventional energy is derived from petroleum and natural gas. (D.S.I.R.).

347. Sources of Information on Air Pollution. Linsky, B. and Smith, G. L. (Washington: U.S. Govt. Print. Off., 1959, Publ. Hlth. Serv. Publ. 654, " Proceedings: National Conference on Air Pollution, November, 1958," 429–442). Discussion of four aspects: characteristics of information on air pollution; problems of obtaining the information; newly developing sources and possible methods for using them. A bibliography lists five national agencies and thirty specific literature references. (D.S.I.R.).

348. The Ascent of Turbulent Forced Plumes in a Calm Atmosphere. Morton, B. R. (Int. J. Air Poll. **1**, 184–197, Jan., 1959). This paper gives predictions of the heights of forced plumes generated when smoke or other effluent is discharged vertically into a stably stratified atmosphere under calm conditions. The theory, which is given in outline, is based on an earlier model treatment of plumes and assumes that mean profiles across the plume of vertical velocity and excess potential temperature are of similar form at all heights and have widths in constant ratio, and that the inflow velocity due to mixture at the plume edge is proportional to the mean vertical velocity within the plume. There are two undetermined constants in the theory, and values for these are deduced from published data on jets and plumes.

The forced plume from an actual source discharging a stream of buoyant effluent can always be related to a virtual point source of heat and momentum only, and the treatment shows how the position of the virtual source may be found. The ascent of forced plumes in a stable atmosphere with a linear profile of potential temperature is then investigated in terms of these virtual sources; it is shown that the height of the plume-top at first decreases as the momentum flow from the virtual source is increased from zero, and then increases without limit. The discharge of cold effluent is also considered.

The practice of discharging stack gases at high velocity does not provide a practical method of increasing plume heights in calm weather, for the mechanical energy needed to give even a moderate increase in the plume height is quite prohibitive.

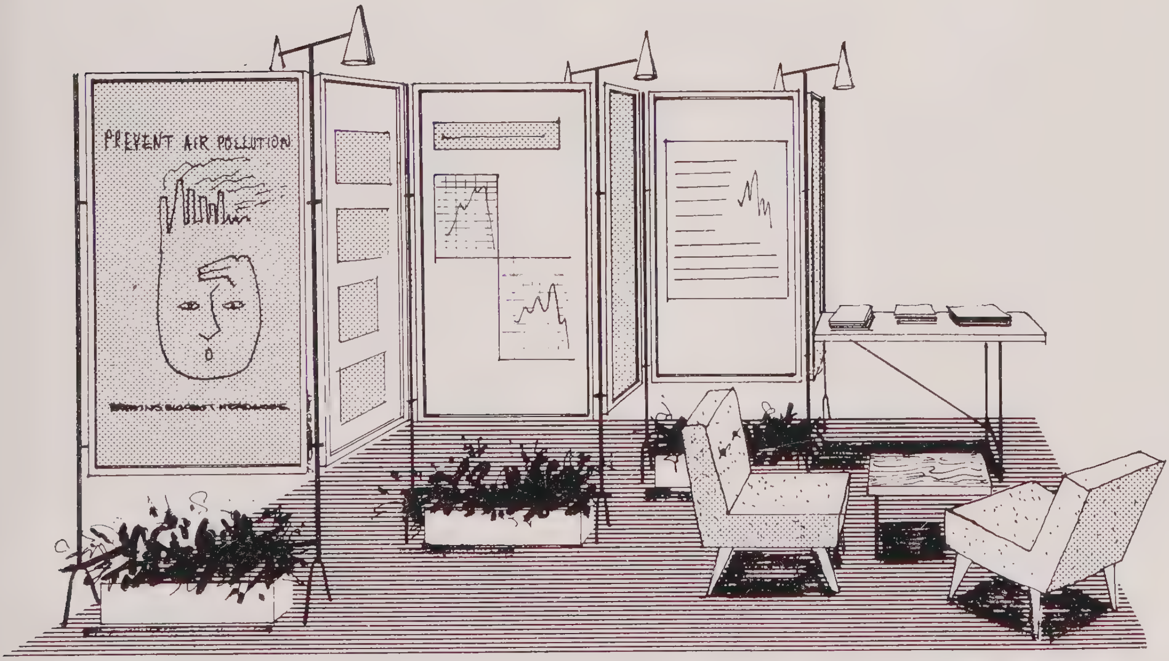
349. The Behaviour of Chimney Plumes. Scorer, R. S. (Int. J. Air. Poll. **1**, 198–220, Jan., 1959). The formulae available for computing the pollution due to an isolated chimney are too complicated to be of any practical use. The weather conditions in which they are correct are not usually the most important that can occur. Therefore, some simpler formulae are proposed: but these have to be used with discretion and with an understanding of the complexities of the actual weather.

The rise due to efflux momentum and buoyancy is calculated using simple formulae derived by dimensional analysis and simple experimental constants. The plume is assumed to be bent over when the upward velocity is about equal to the wind speed and the rise is assumed to be complete when the upward velocity is reduced to a certain fraction of the wind speed. When the rise is complete, the effluent is carried passively by the ambient turbulence. The formulae acknowledge three different regimes in which the efflux momentum, the buoyancy, and ambient turbulence successively dominate the mixing process.

When a plume contains liquid water an appreciable amount of heat may be lost when it evaporates on mixing with the environment. A diagram is given for computing the effect in the buoyancy. It may be enough to make the plume sink rapidly to the ground.

Finally it is argued that architects should accept the chimney heights necessary for the proper dispersal of pollution as a requirement and design their buildings with the chimney as an integral part instead of as an undesirable appendage.

350. The Colorimetric Determination of Sulphur Oxides in Atmosphere. Kanno, S. (Int. J. Air Poll. **1,** 231–233, Jan., 1959). In this report are described first the colorimetric determination of the total sulphur oxides in atmosphere, and second, the colorimetric modification of the lead peroxide method. The determination of the sulphur oxides can be carried out exactly and concisely by these colorimetric methods.



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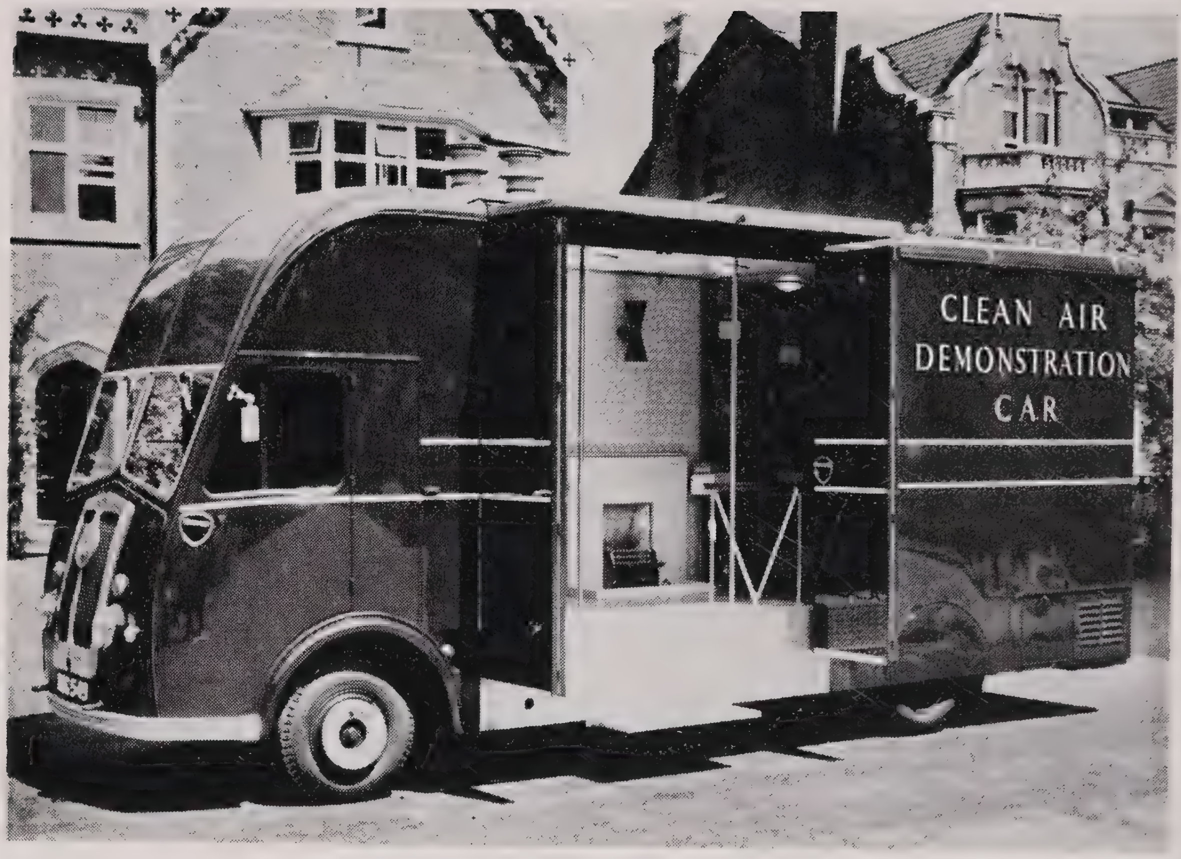


Clean Air Demonstration Vehicle

The West Midlands Gas Board now have two mobile showrooms to help in promoting the sales of coke—especially in Smoke Control Areas. One of these is illustrated above.

They have been designed by the Publicity Department and have a showroom space of 18 ft. x 7 ft. Double doors give an opening of 8 ft. and a canopy can be extended over the entrance to give protection from the weather.

Exhibits include two live coke-burning appliances in conventional surrounds. Also displayed are four inset fires, two convector fires, two openable stoves, in addition to gas pokers and samples of coke.

The vans are operated by two salesmen, one acting as the driver.

Huddersfield Turns to Verse—Among the many excellent publicity devices used in Huddersfield for their week in the recent West Riding Clean Air Campaign was the publication of a little duplicated booklet, with a coloured cover, entitled *Clean Air Ditties*. It was just the thing to give to the children, and except for the fact that all publication rights are reserved by Huddersfield Corporation we would advise other local authorities to copy it! Most of the ditties—which are illustrated—are nursery rhymes, as one or two examples show:

" Humpty Dumpty sat on a wall
Watching his chimney—ever so tall
He fell with a wallop and scattered his yoke
When he saw that his chimney was turning
out smoke."

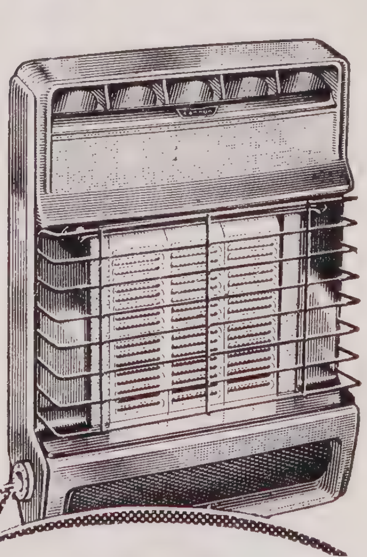
" Mary, Mary, Quite Contrary,
Oh! how your chimney does smoke.
Fit a modern appliance
And place your reliance
On SMOKELESS, like sensible folk."

And finally:

" Here lies the body of Bridget Twist
A dear old soul who is now sadly missed;
Wherever she went she acted quite fair,
But expired through pollution inhaled in
the air."

NEW CLEAN AIR POSTERS GOING WELL

The new series of prize-winning posters published by the Society is selling well, and is a "must" for any clean air publicity campaign. If you have not yet seen it, send for the folder illustrating the posters in full colours, with prices, etc.



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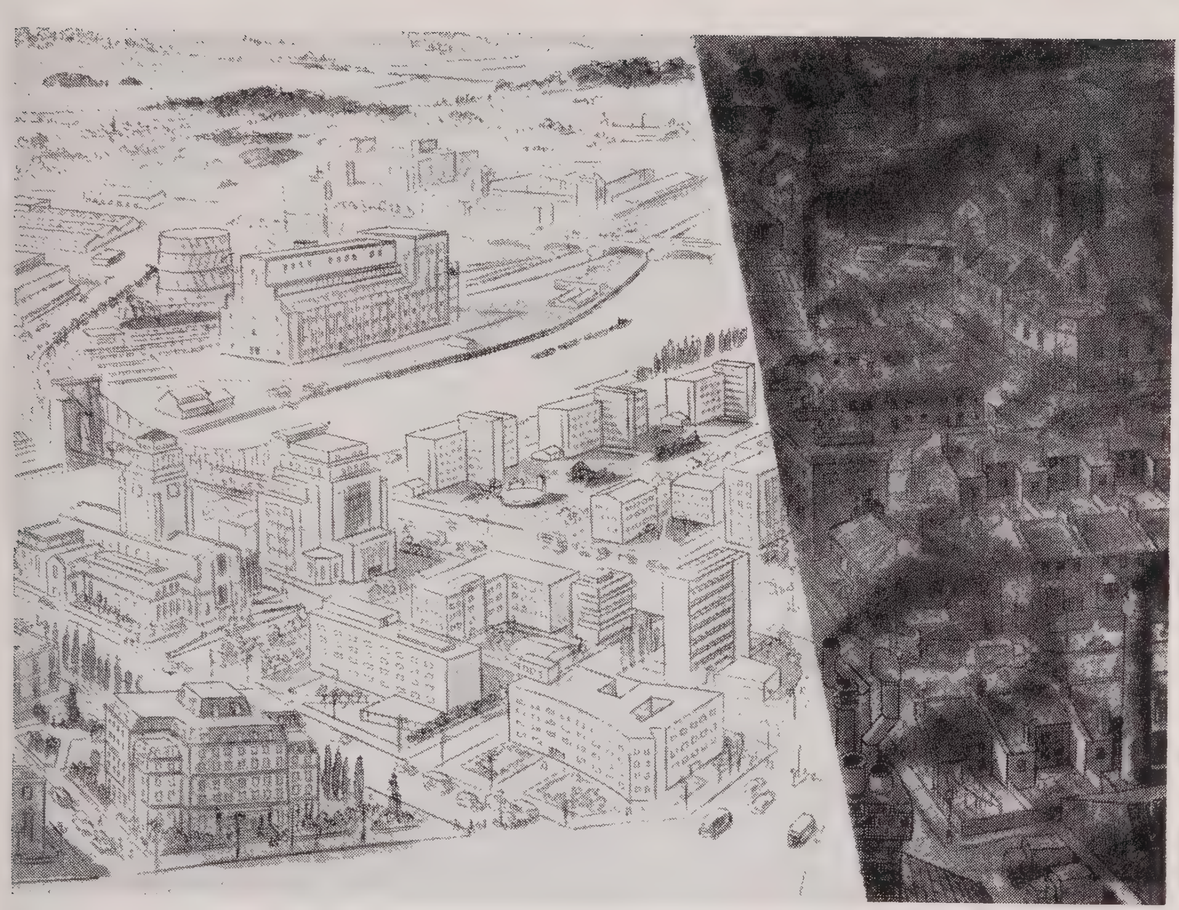

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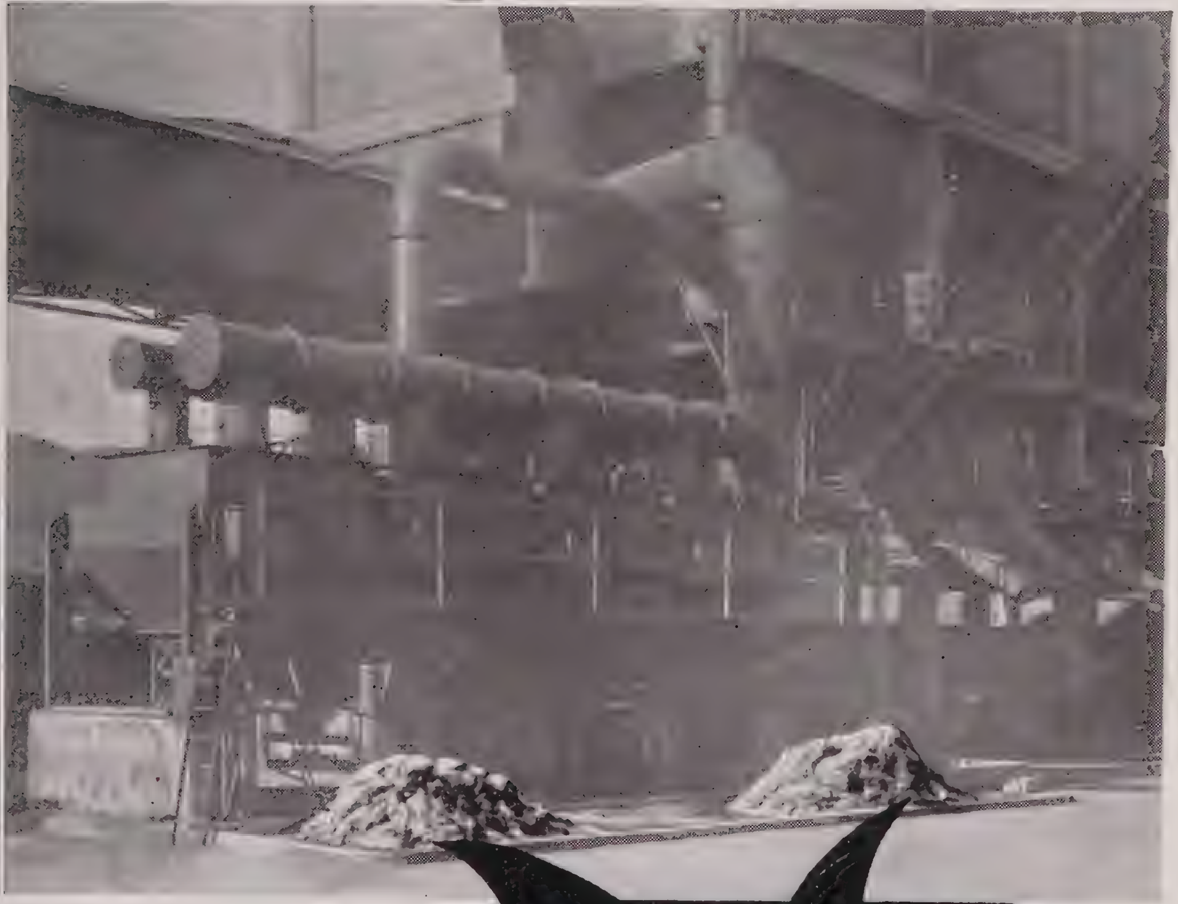

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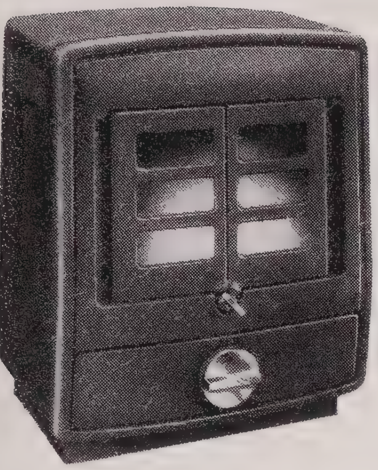

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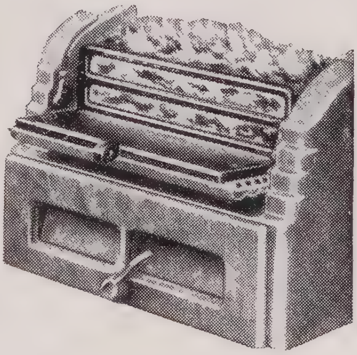

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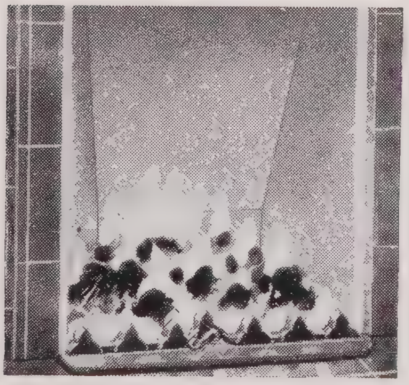

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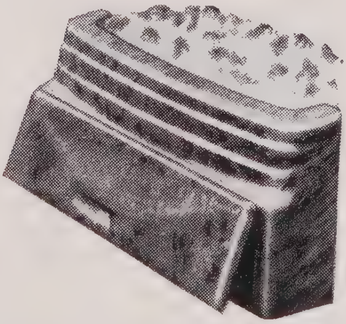

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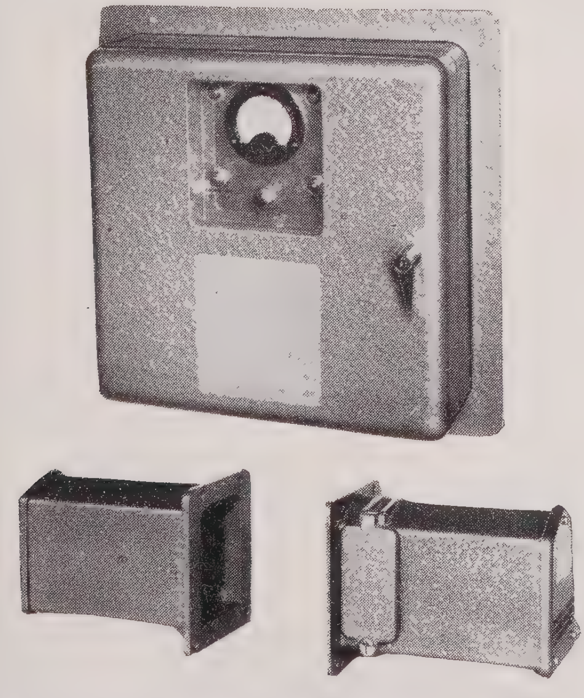
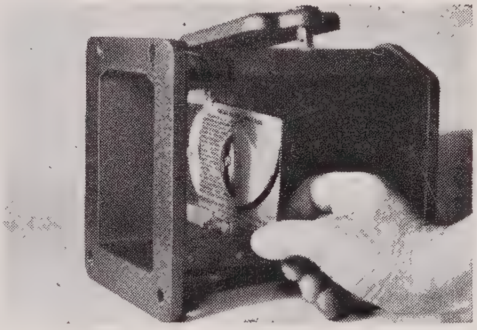
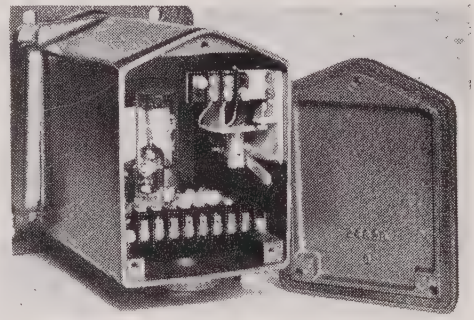
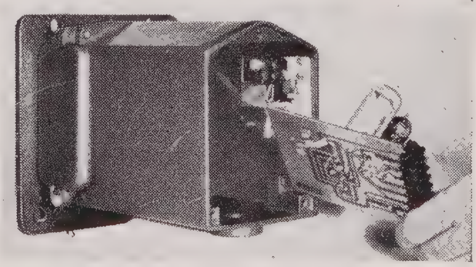
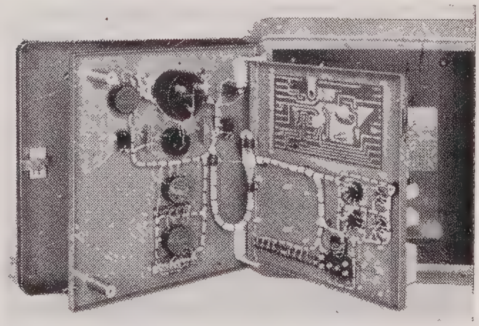






Calibration check by manual insertion of check slide or, in lower illustration of head with remote standardising unit, by push button from main unit.





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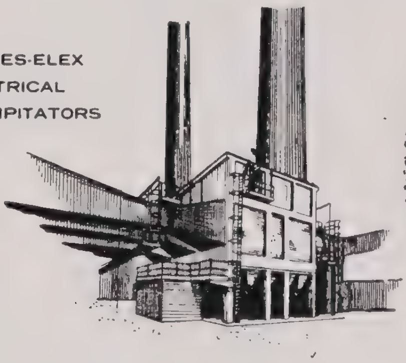

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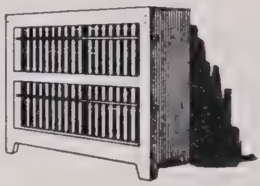

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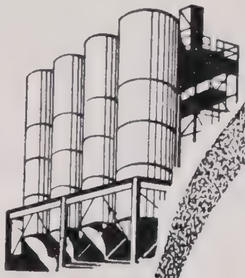

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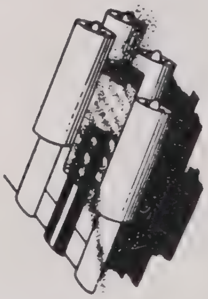

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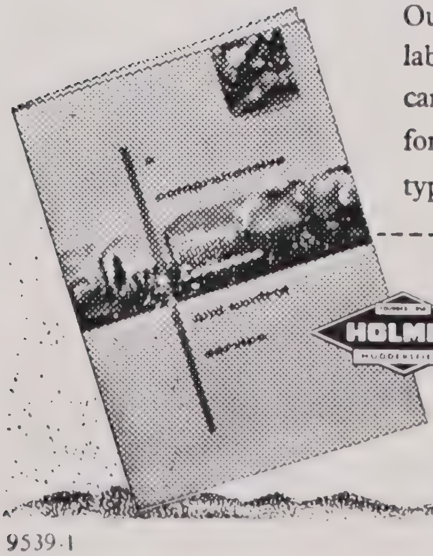

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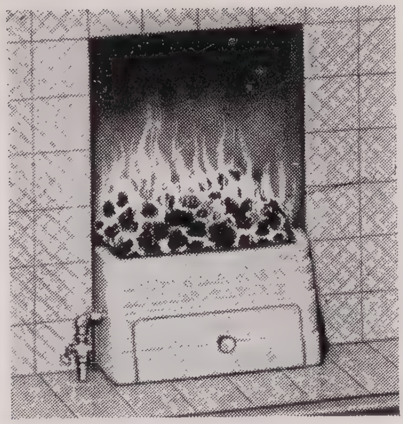

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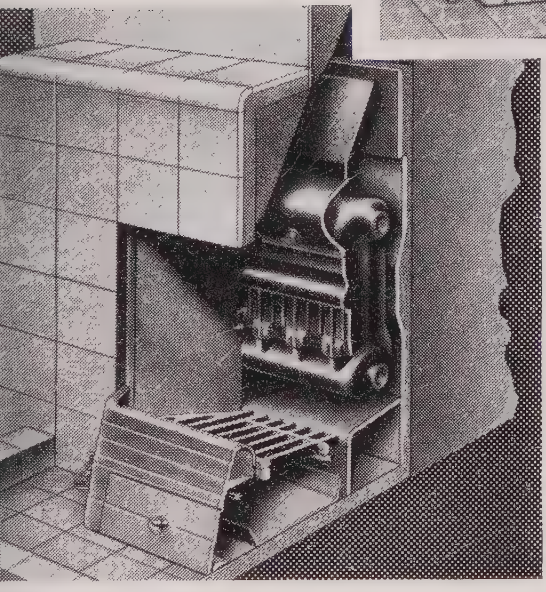

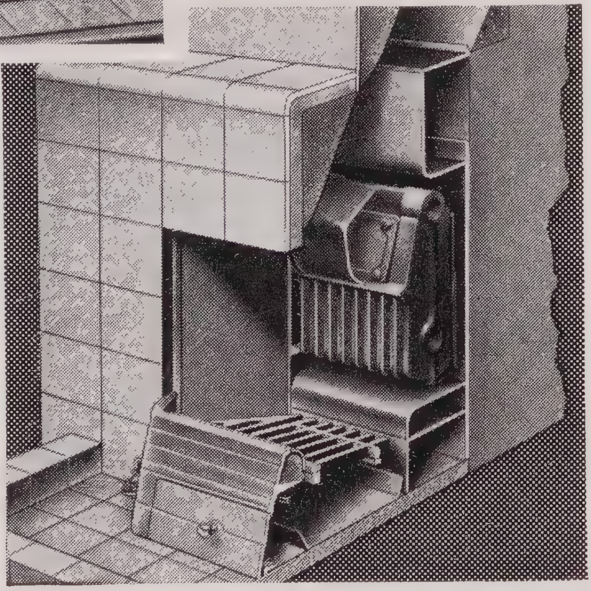

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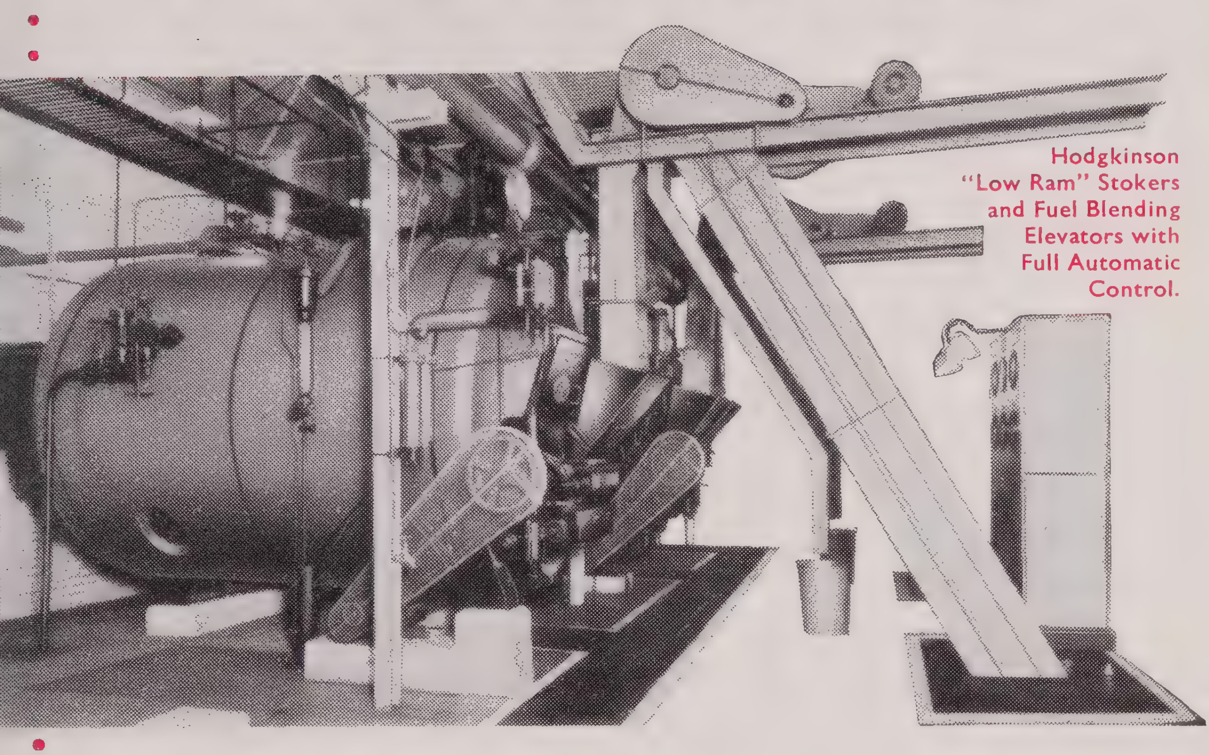

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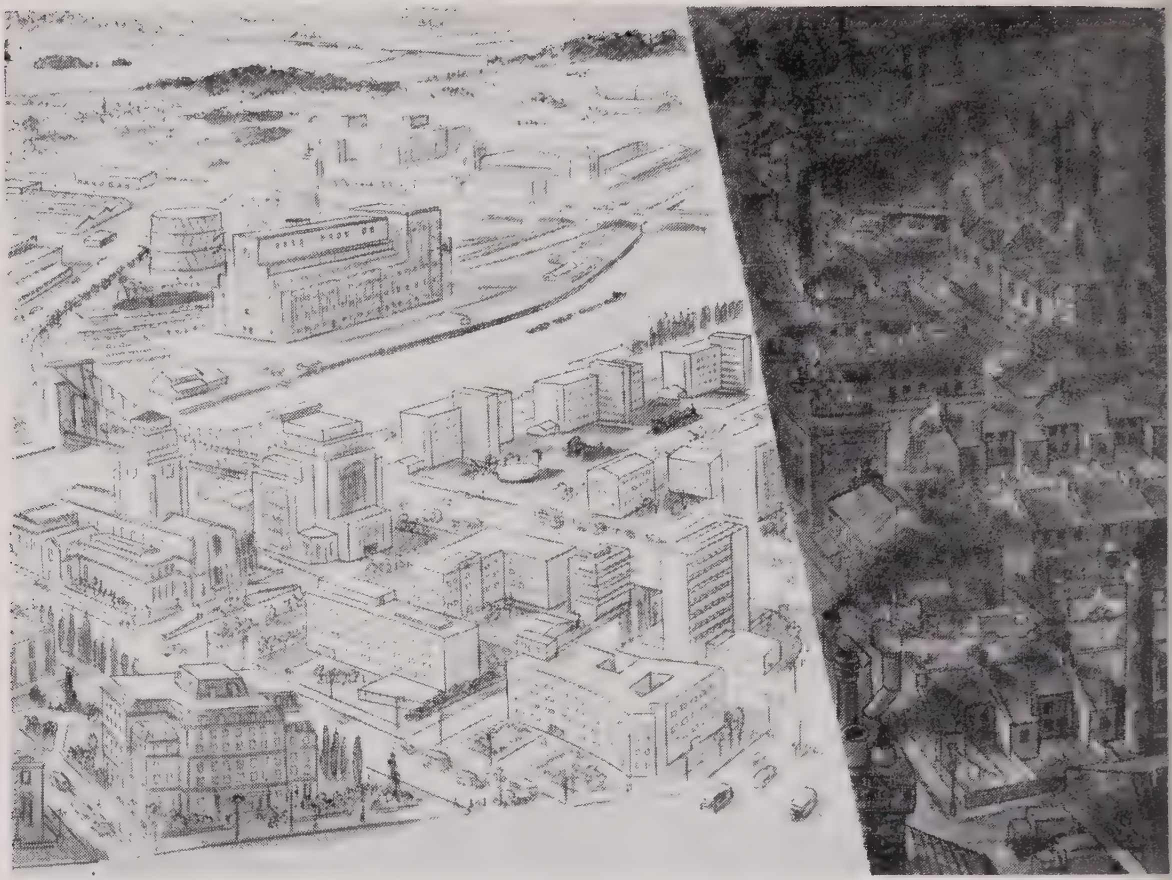

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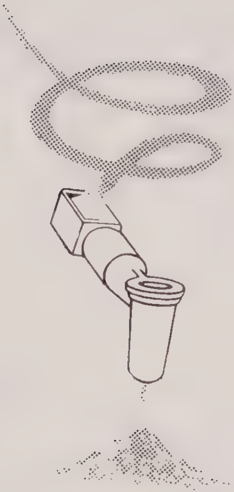

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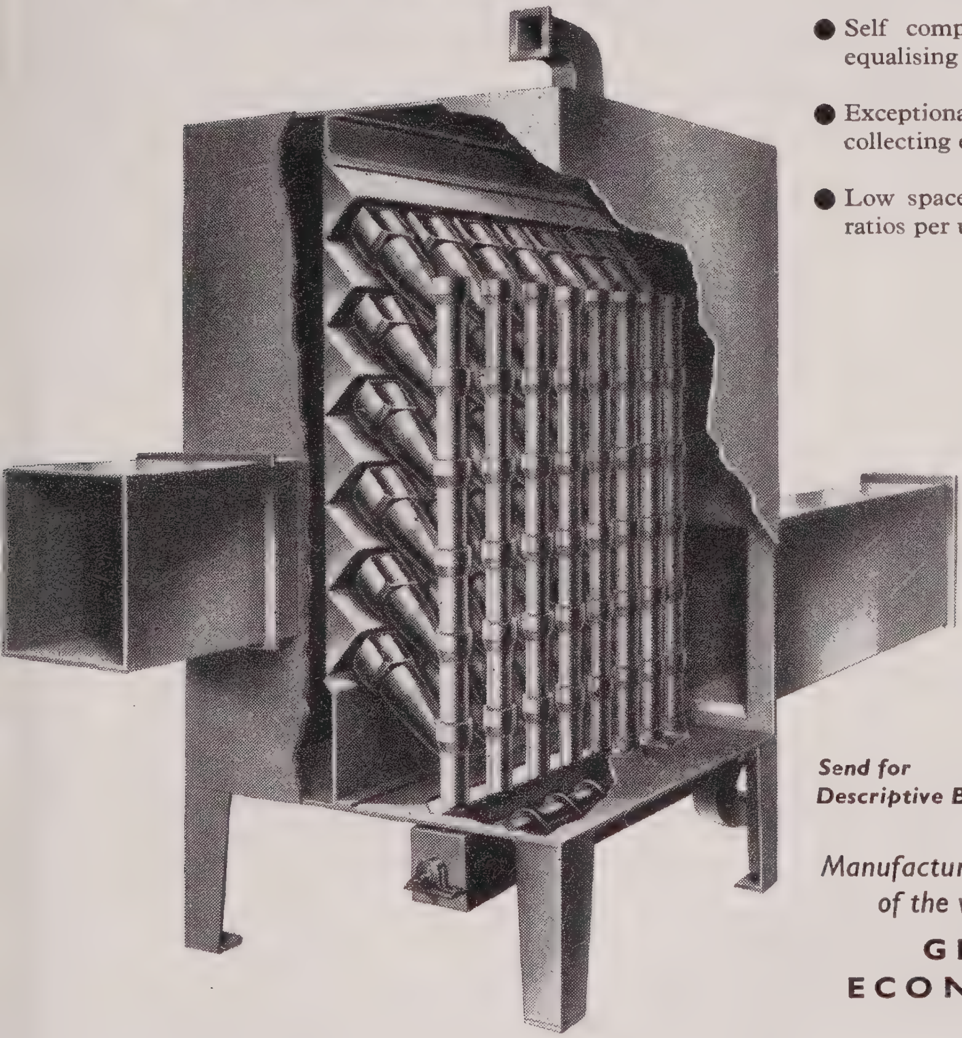

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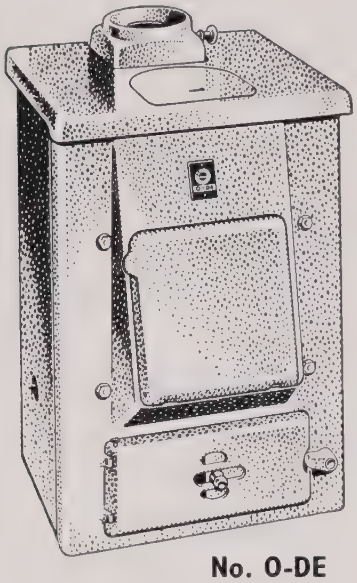

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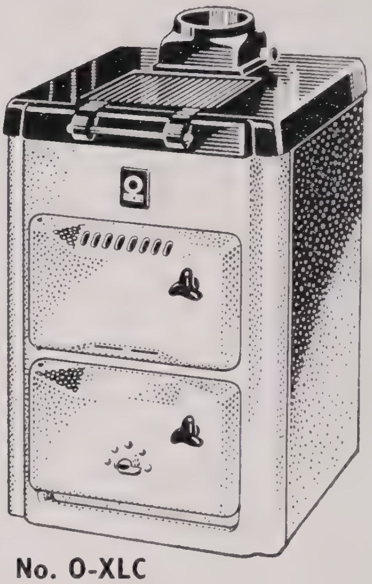

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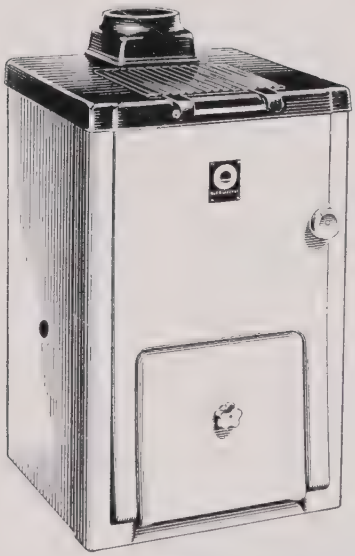

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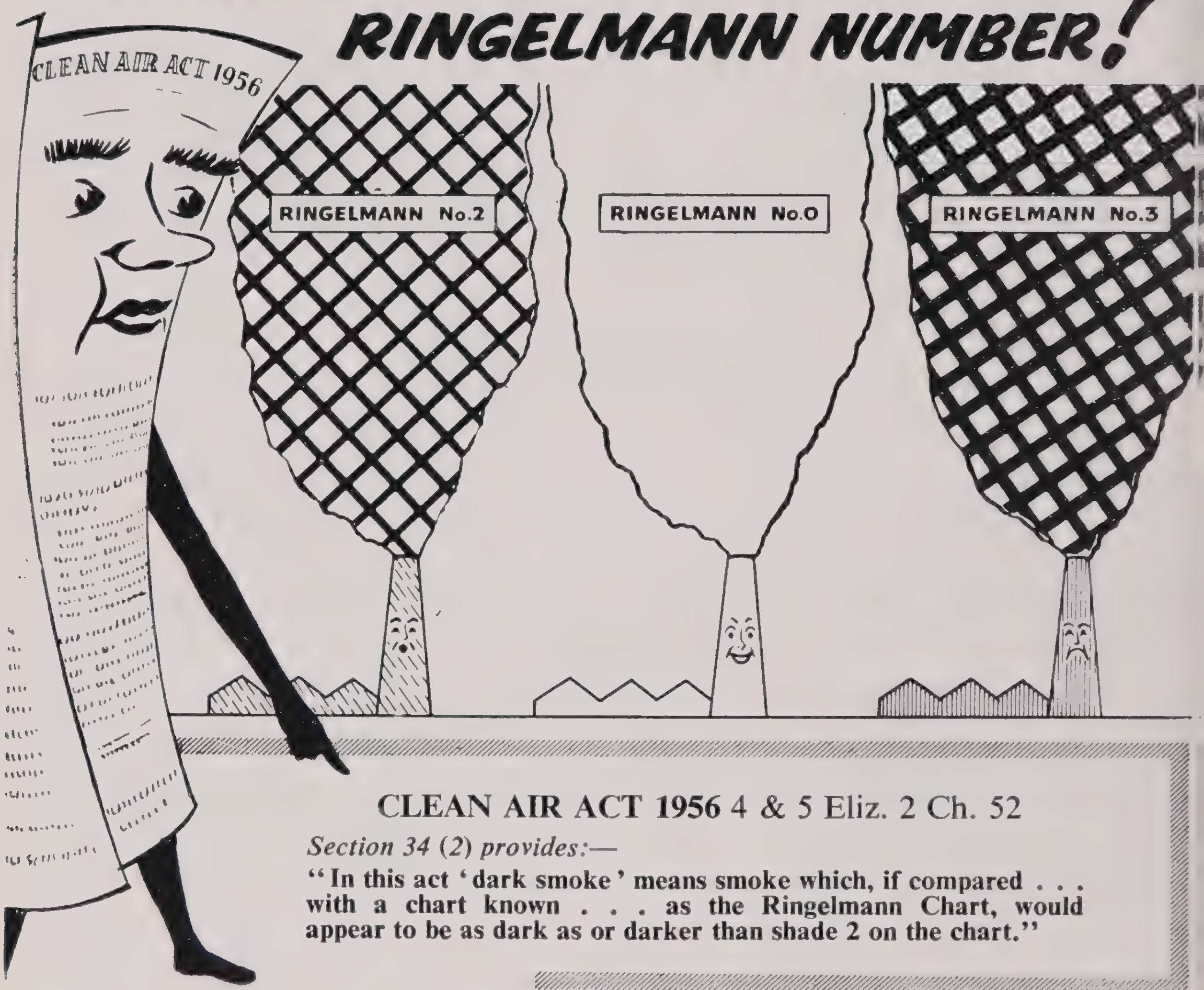

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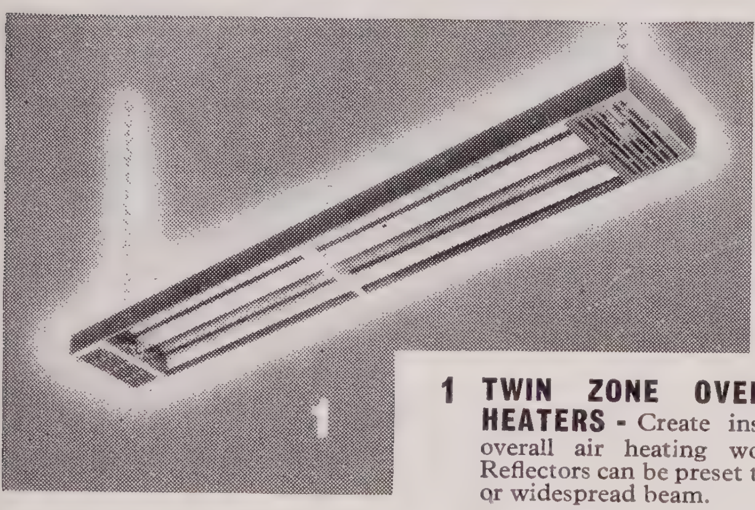

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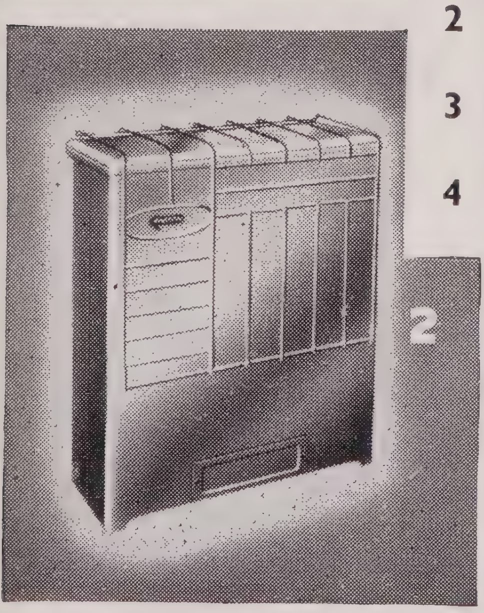

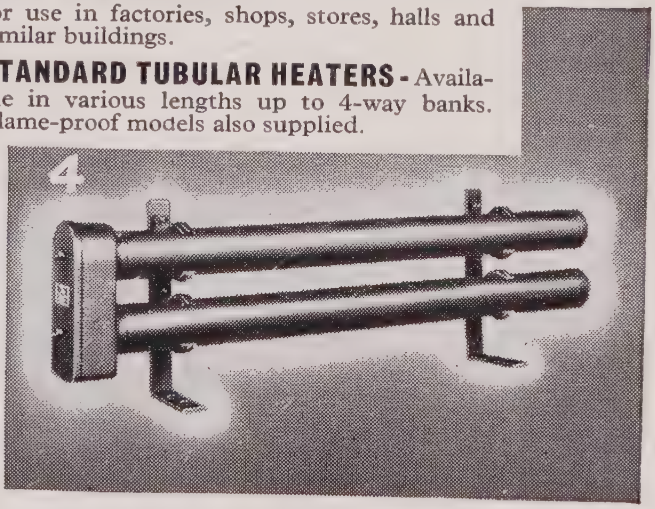

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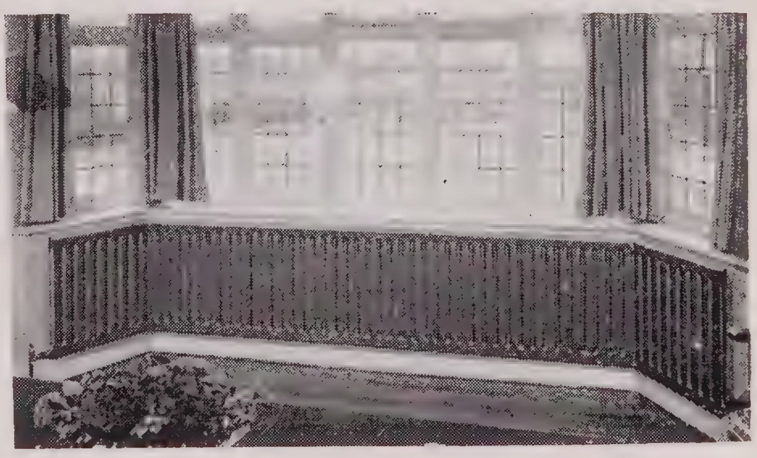

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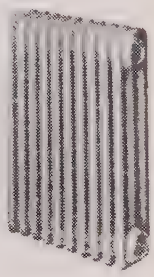

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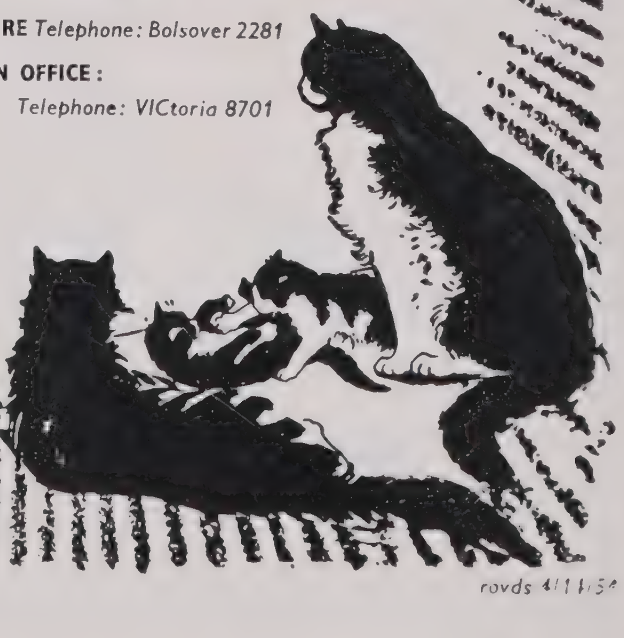

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Harrogate—5th, 6th, 7th October

Subject to conditions to be issued, an open invitation is extended for the submission of short papers or reports on technical and other developments, research progress, etc., in the field of air pollution prevention.

Inquiries are also invited for the reservation of space at the Exhibition to be held in conjunction with the Conference.

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INTERNATIONAL CLEAN AIR CONFERENCE

London, October, 1959

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SMOKELESS AIR

Vol. XXX No. 112 Winter 1959

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SMOKELESS AIR is the official organ of the Society, but the views expressed in contributed articles are not necessarily endorsed by the Society. Abstraction and quotation of matter are permitted, except where stated, provided that due acknowledgments, including the name and address of the Society, are made.

Ships, towers, domes, theatres and temples lie
Open unto the fields, and to the sky;
All bright and glittering in the smokeless air.

SMOKELESS AIR

After the Conference

IT is not easy, so soon after the event and from the inside, to judge the degree of success of an event such as the Society's recent Diamond Jubilee International Conference and Exhibition. But it is interesting and useful to try to take a kind of private opinion poll, noting and balancing the views of those who see the conference as a huge success and of those who, for one reason or another, are critical or disappointed. It has been gratifying that the great majority whose comments we have heard or read feel that the conference was a great and memorable occasion in the history of the Society, that it was a fitting way to celebrate the jubilee, and that it was a tribute to the Society that the event should have aroused so much world-wide interest and representation.

Although there may be others who share the feelings of the writer, we have in fact received only one letter of criticism about the nature and programme of the conference, and this is printed on another page. As the immediate local problems to which he refers can be, and are being, discussed in the Divisions, and as it will not be long before another national conference returns to them at full strength, we cannot agree that the point counts very heavily against the unique value of the International Conference. The attention that it has focused on air pollution, in this country as well as overseas, the wider publicity it has received, and the impetus it will give to many aspects of future work, will be of greater and more lasting value than any ordinary conference, and because of this they are likely to be of greater value in the long run to the local authorities themselves.

The vital statistics about the conference are that it was attended (apart from guests and visitors) by 1,071 members and delegates from the United Kingdom, and 180 from overseas, making a total of 1,251. Seventy-eight written contributions for discussion were received and accepted, of which 54 were from overseas. Over 400 delegates took part in the thirteen different visits that were arranged for the final day. Thirty-one exhibitors participated in the Exhibition, and many more would have done so if there had been room for them.

Interest in the event grew greater as the date came nearer. Although the beginning of July had been stated as the final date for the sending in of Papers, they continued to arrive until the end, creating printing problems that were not made easier by the printing dispute and its aftermath. Registration of delegates was asked for not later than the middle of August, but applications were being received (and accepted!) right up to the hour of opening.

It will be some months before the final volume of Conference *Proceedings*, with the discussions, Rapporteurs reviews, etc., can be published, and in the meantime we are devoting much space in this and the next issue of this journal to conference reports. We are publishing the abstracts of all the Papers presented, plus the Address by Sir Graham Sutton, the speeches by the Minister of Housing and Local Government and the Lord Mayor of

London, and one Paper of immediate domestic importance—the contribution by Dr. Bronowski, in which was announced some important news of the developments by the National Coal Board for the production of smokeless fuels. In addition there are the messages received from the Patron, H.R.H. the Duke of Edinburgh, the Prime Minister, the President of the American Air Pollution Control Association, and lastly one from our own President, Sir Hugh Beaver, whose absence through illness was deeply regretted. We are very glad to be able to say that Sir Hugh is making a good recovery.

International Co-operation

Perhaps the most potentially important theme that came up in the conference was that of the possibilities of some form of international co-operation and organization, probably in quite a simple form to begin with, for the purpose of permanent international liaison, exchange of information, and so on, especially in the fields of research and technical development. This was stressed in particular by Mr. Peter Isaac and Mr. J. O. Buxell in their papers, by Mr. Ieuan Lewis in the final discussion, and by several of the U.S. delegates. Mr. Cohen, presiding at the last session, stated that the whole question would be discussed by the Society's Executive Council. It is a development that is clearly needed, but equally clearly it calls for much thought and discussion, perhaps rather diplomatic discussion, if it is to be started and to grow into something really effective and fully international in character.

Gas and Electricity

We review in this issue the new annual reports of the national electricity and gas industries, both of which are doing so much for clean air. Each of the reports, pointing the way to future developments, suggest ways in which the present pattern of fuel usage may begin to change in ways that will assist the fulfilment of the Beaver report programme, especially through the more rapid expansion of smoke control areas. The progress that we want to see depends very largely on the increasing production of suitable solid smokeless fuels to several times their present output. Even with continued improvements in the quality and quantity of coke and the so-called premium fuels, and even with the help of the new processes being developed, the future demands for solid fuel may be difficult to meet in full. Solid fuel has been regarded as the principal and essential component of the basic domestic heating load, which has to include the abnormally heavy demand that is experienced at short notice during very cold weather. To try to meet this demand with gas or electricity, except marginally, has not seemed practicable because (among other factors) it would require generating or carbonising plant that would be unused during most of the year. If, however, off-peak electric storage heating methods are developed more rapidly (and cease to be hampered by purchase tax obstacles) they can do much to ease the burden on the solid fuels. Gas could even play a bigger part if possibilities discussed in the new report should materialize. There is the possibility of finding natural underground storage (as in France) which could be used for holding large quantities of gas for the winter and peak periods, and there is now the prospect of doing the same thing by storing the liquid gas of which the importation of big supplies now seems quite probable. Whether it would be economic to compress or liquefy and store home-made coal gas in a similar way we do not know, but it would be valuable if it could be done. Even if the part that gas and electricity (and also oil) could play in meeting the peak demands were to prove to be only limited, they might nevertheless make possible the establishment of some of the smoke control areas that otherwise may be delayed because of future shortage of solid smokeless fuel.

Dame Vera

It is with the deepest regret that we have to record the death on September 25th, her 71st birthday, of Dame Vera Laughton Mathews, a Past President of the Society. Dame Vera will be remembered with respect and affection by all the members of the Society who had the pleasure of meeting her or of hearing her speak at our conferences. She was President for the years 1949 to 1951, when she was also Chairman of the Domestic Coal Consumers' Council set up after the nationalization of the mines. Later she became Advisor on Women's Affairs for the Gas Council, a post she occupied with great distinction and success. Her great work, of course, was as Director of the Women's Royal Naval Service during the last war—returning to the service in which she had been a junior officer in the 1914-18 war. She led the W.R.N.S. for seven and a half years, and was created a D.B.E. in 1945. Speaking in the House of Commons on this work Mrs. Cazalet Kerr paid her a tribute that all who knew her will endorse: " She seems to me to combine two very important qualities in a leader, great humanity and sound commonsense." Another writer has said of her that she gained the affection of officers and ratings alike, and that " it was said of her that she knew every one of her officers, and her memory was remarkable. She had the gift of wise selection. She was a big woman physically and mentally; her deep musical voice and cheery laugh were expressive of a kindly, generous nature." She could be, and sometimes was, a somewhat formidable person, demanding efficiency and celerity, but very quickly able to disarm opposition by a twinkle of the eye, or a charming smile and word. Her lively sense of humour and understanding of and sympathy with people was endearing and it was she herself who kept alive the delightful story of the American journalist who after interviewing her had described her as " a grand old lady sea dog."

Time for a Change?

We wonder if any readers have compared, as far as page size is concerned, their *Smokeless Air* with the *Sixty Years for Clean Air* that was published for the International Conference, and if so which size they prefer? *Smokeless Air* went down to its present dimensions during the war and has remained the same since then (except for the number of pages). We know that some readers prefer the present pocket size, but there are practical advantages in a larger page, especially for illustrations and advertisements. Has the time come for a change back to the *Sixty Years* size? We shall be glad to have your opinion on a postcard.

Mechanical Stokers

The Smoke Control Areas (exempted Fireplaces) Order, 1959, which has the effect of exempting from control in smoke control areas mechanical stokers and two named appliances, came before the House of Commons on November 10th and 11th, when a Prayer to annul the Order was moved and debated (see our last issue, Autumn, 1959, p. 18). This was brought up, we understand, at the request of a number of local authorities who are not very happy about the blanket exemption of mechanical stokers burning coal. The report of the debate comes to hand as we are going to press and too late for full reporting in these pages, but it may be said that the debate was of a rather discursive, far-flung character, in which the competition between coal and oil, miners' concessionary coal, and the rights of local authorities all crept in. Little criticism was made of the form of the Order, and one of the main points made was that it would mean that in smoke control areas there would be smoke allowed from industry and prohibited from domestic chimneys, thus creating a sense of unfairness. This, of course, has been realized for a long time to be one of the difficulties

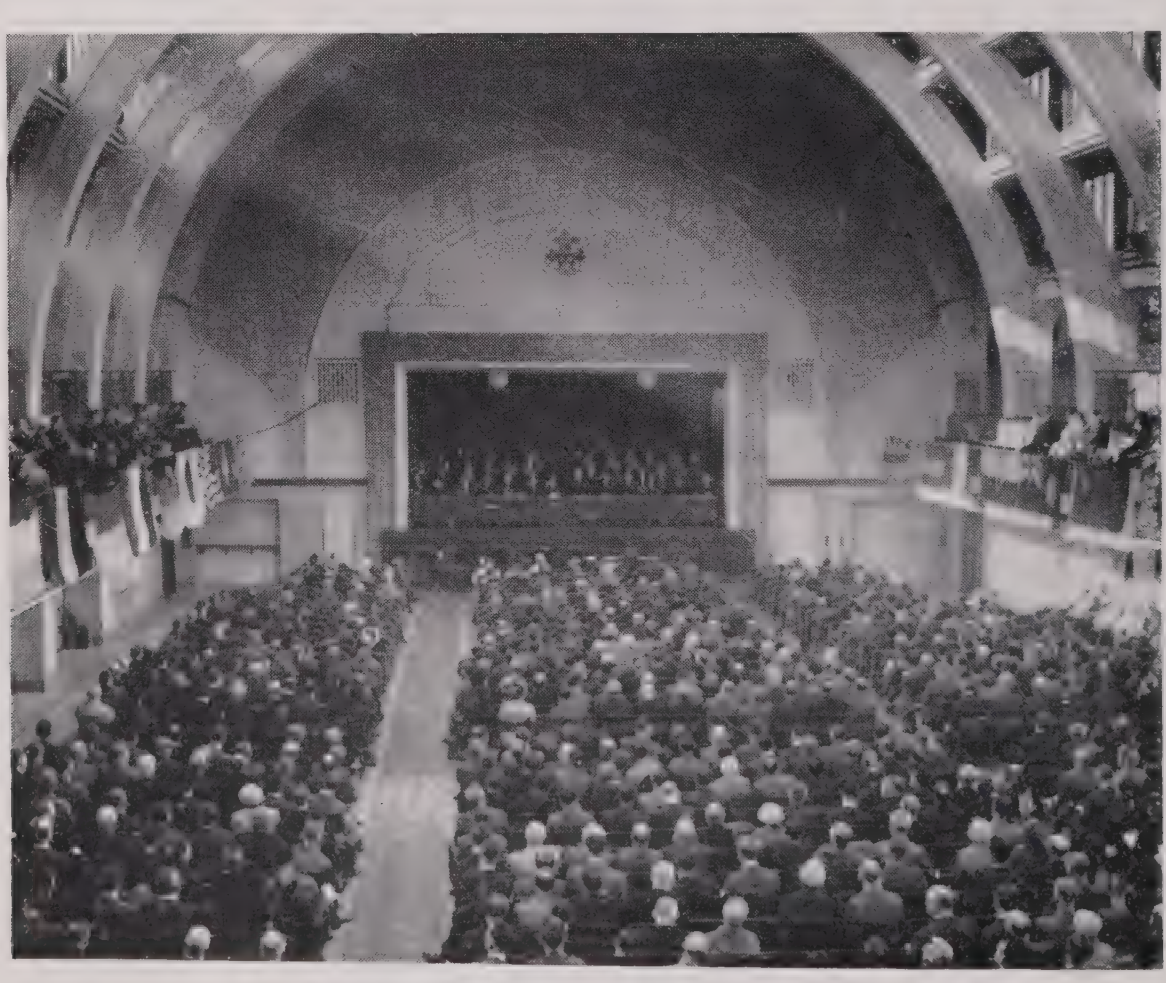
(*concluded, page* 99)

Report on the Conference

A Survey of the Main Events

SOME comment on the recent Diamond Jubilee is given in the editorial notes. Here is a report of some of the main features of the event. The Conference was held in the Seymour Hall in the Borough of St. Marylebone, the large hall (in the summer a swimming bath) being used for the meetings and the Exhibition mainly in adjoining rooms. All the space available for the purpose was occupied by the exhibitors, with a few stands in the meeting hall and others in the main entrance foyer, To sum up the Exhibition briefly, it may be said that it was not only informative and interesting but was staged in a very attractive manner. We were in fact informed that it was the best exhibition ever shown at Seymour Hall. It was well visited by the 1,250 delegates, and also by members of the public, especially technologists, local government officers and students. Exhibitors, and it is their view that counts, have since expressed themselves very satisfied with the interest shown.

The opening of the Conference itself, always a crucial moment, took place in a crowded hall. A full and representative platform had been arranged, and the international character of the meeting was reflected in the thirty or so flags of all the nations represented that were hung from the balconies. Among the platform party it was a pleasure to see representatives of some



A general view of the Conference in Session

The Minister of Health, Mr. Henry Brooke, M.P., at Session II

of the former leaders of the Society—Mrs. Charles Gandy, Mr. Brian Melland and Mr. G. L. C. Elliston.

In the chair was the Senior Vice-President, Sir Graham Sutton, F.R.S., Director-General of the Meteorological Office, deputising for the President, whose absence was regretted by all. Sir Hugh was, however, able to send the message that was read by Sir Graham and is reproduced below.

The proceedings were opened by the Mayor of St. Marylebone, Councillor Lt.-Col. H. C. S. Thomson, O.B.E., who welcomed the delegates and the guest of honour, the Lord Mayor of London. The Lord Mayor, in addressing the meeting formally opened the Conference and Exhibition. Before delivering the Address he had prepared at very short notice, and which is printed on another page, Sir Graham read to the meeting a series of messages that had been received.

The first was from the Patron to the Conference and Exhibition, H.R.H.

The Mayor of St. Marylebone welcomes the Lord Mayor of London outside Seymour Hall the Duke of Edinburgh. His Royal Highness had written:

An industrial society has many advantages but one of the disadvantages is dirt. The water and the air is full of it and this pollution kills fish and vegetation, covers the countryside with grime, turns buildings black and starts them crumbling, and attacks our lungs sometimes with fatal results.

The problem of pollution of the air is common to all industrial centres anywhere in the world and it is therefore most encouraging that so many delegates from Overseas have come to take part in this Conference on Clean Air.

As Patron of the Conference I offer a sincere welcome to all the delegates and extend my best wishes for the success of the discussions and for a happy and enjoyable experience.

I cannot imagine a more suitable way for the National Society for Clean Air to celebrate its Diamond Jubilee and I am sure that the discussions at this Conference will go a long way to solving some of the acute problems of the pollution of the air.

(*Signed*) *Philip.*

Then came a message from the Prime Minister, the Rt. Hon. Harold Macmillan, M.P., which was as follows:

The National Society for Clean Air have played a distinguished part in the long battle against the evils and dangers of air pollution in this country. I congratulate the Society warmly on sixty years of successful and public-spirited work, and I send them my good wishes for the future.

I congratulate the Society, too, on their decision to celebrate their Diamond Jubilee by holding an international conference on clean air. Much has still to be learned about the ways in which air pollution can best be controlled, and here surely is a fruitful field for the pooling and exchange of knowledge and experience and for the interplay of opinion. I wish the Conference every success.

From the United States came a letter to the President from the President of the Air Pollution Control Association, Dr. Leonard Greenburg, which read:

" *As president of the Air Pollution Control Association, which is now in its 53rd year, allow me to extend our congratulations and greetings for a most successful and fruitful Diamond Jubilee Conference. Our own Board of Directors has formulated a policy of international co-operation with the eventual objective of forming an international commission. We are certain that conferences such as this one will eventually assist materially in achieving fulfilment of this objective in the near future.*

" *In the meantime we anticipate that our delegates will bring back helpful advice from other countries in handling our own air pollution problems, and by the same token we hope our experience in handling our local problems will prove valuable to the other delegates from around the world.*"

And finally a message from our own President, Sir Hugh Beaver:

I owe my profound apologies to this great Conference that I am not able to be with you. I had been looking forward with the greatest interest to taking part in it, and to hearing the papers and the discussions, but unfortunately that has not been possible.

I have had an opportunity to read the advance proofs and I am confident that they form the basis for a most valuable meeting. I am struck by two things in particular:

(*i*) *How widespread now is the recognition of this lethal danger of man-made air pollution, and*

(*ii*) *How basically similar are the problems everywhere.*

I would only make two points here. The first is that the remedy can only be found by stages; the fact that we have not yet the whole answer should never be accepted as an excuse for not taking action. The second point is this, that you all show by your presence here that you are a little in advance of general public opinion. But in the end it is public opinion and that alone that will secure full and effective action.

At the Opening Session: the Mayor of St. Marylebone speaking

It is thus a question of education and of timing. I wish you all success in your deliberations.

Sir Graham Sutton then read his address, for which he was thanked in a vote moved by Dr. R. Lessing, the Immediate Past-President, and seconded by Dr. J. S. G. Burnett, Chairman of the Executive Council.

The Minister's Address

The first of the sessional meetings, at which the many papers that had been presented were discussed, was formally opened by the Minister of Housing and Local Government, Mr. Henry Brooke, M.P. Because of the General Election and subsequent changes in the Government the other Ministers who were to have opened sessions were unable to do so, and the Society was therefore very grateful to Mr. Brooke for keeping to his firm intention of being with us. His speech was brief and is recorded in full:

"As the Minister responsible in England and Wales for the drive for clean air," the Minister said, "I am proud that this great International Conference is being held in London and delighted to have been asked to open this afternoon's session. I congratulate our National Society for Clean Air on celebrating its Diamond Jubilee thus.

"The one sorrow is the illness of the Society's President, Sir Hugh Beaver. He has won for himself a unique reputation, not only by having been Chairman of our Committee on Air Pollution which paved the way for the Clean Air Act we passed in 1956, but also by his tireless leadership in the cause of clean air, particularly among his fellow industrialists. I know we all wish him a speedy recovery.

"You are going to discuss this afternoon the various ways in which the countries of the world are tackling the pollution of the air, according to their own geography and climate, their own economic and industrial backgrounds, their own social customs and constitutions.

" In our country we know we have still far to go. But the claim we can justifiably make is that we have enacted legislation on a national basis which, if we implement it vigorously enough, will clean the air before people now middle-aged leave this life, and in time for the children now being born never to know what the filth in the air of many of our towns and cities was.

" There are two features of our historical situation in this country that I would put on record. Under earlier Acts of Parliament going back nearly a hundred years we have had a steadily strengthening and broadening control through inspectors employed by the Central Government over the most harmful or offensive forms of industrial pollution of the air—the forms which can only be dealt with by men with specialized qualifications and experience.

" A tradition of partnership has been established between these Central Government inspectors working within their specialized sector and the local authorities who are charged by Parliament with responsibilities over the rest of the field. We have cause to be well satisfied with the working of this dual system.

" But the other historic feature of this country is unhappily nothing to be proud of: it is the extremely heavy smoke pollution from which our towns and cities have suffered for far too long. The significance of our 1956 Act is that we have now decided as a nation that this menace can be tolerated no longer.

" We have started to reclaim our right to sunshine and clean air. It will wipe out one standing international joke—the yellow fog of a London winter. A London fog is anything but a joke when you are in it, and now that man can send rockets to the moon it is high time for man to stop the life of London being brought to a standstill by smoke which makes evil-coloured fog and poisons people in the process.

" Luckily we know now that we can work to get rid of this smog without getting rid of a cherished feature of the British way of life, the open fire. Fortunately there are solid fuels now which burn as well in open fires as coal, or even better, and give out no smoke. In towns we shall look more and more to these solid smokeless fuels, as well as electricity and gas and oil.

" I must not keep you longer. On these eighteen learned papers you have more than a full afternoon's work to do. We are all on the side that now is bound to win. To get the pollution out of the air is a huge task, but every year is going to bring us closer to final victory. The whole world is realizing that the cost of dirty air, in terms of material economic damage, and extra domestic work, and illness and even death, is gigantic. It needs the giant strength of every nation to defeat and destroy the dirt. But with everybody's help and determination, it can and will be done."

The Business Sessions

After the Minister's address the session took the form that was to be followed on the following days. That is, the authors who were present were on the platform and were introduced by the Chairman. Their papers were then reviewed by a Rapporteur, and the meeting was then thrown open for discussion, after which the authors who so desired were able to make a spoken reply. On the Thursday afternoon, the last session, the procedure was different, with a final general discussion, preceded by reviews of the discussions on their own sessions by the Rapporteurs, followed by a closing survey of the whole of the proceedings by Mr. T. C. Bailey.

A number of the overseas delegates participated in the discussions, but it was wished that more had found it possible to do so. No doubt language difficulties were a factor. There was a feeling, too, that some of the discussions were rather too parochial and insufficiently international for the occasion. Nevertheless, the sessions went smoothly and usefully, and without the sense of congestion that so large a number of papers might have caused. For this excellent course of events must be thanked the sessional Chairmen, Dr. Burnett, Dr. T. P. Colclough, Mr. John Innes, Dr. J. L. Burn, and Mr. Stanley E. Cohen, and the Rapporteurs—Professor Andrew Semple, Mr. Gordon Nonhebel, Dr. E. T. Wilkins, and Dr. Charles Forrester. Mention must also be made of the opener of the Wednesday afternoon session, Sir David Anderson, Chairman of the Clean Air Council for Scotland, who made a very helpful speech. It was fortuitous, but pleasing, that his Chairman should have been the President of our Scottish Division, Mr. John Innes. A letter published on another page mentions the stimulating nature of the sessions, and we have also been gratified by the impressions of one of the German delegates, who referred to the " extraordinarily harmonious and friendly " atmosphere of the conference."

The series of visits—thirteen in all—arranged for the Friday, all went off without incident, although a number of delegates who had reserved places failed to turn up. But those who did take part were highly appreciative of the arrangements and the hospitality with which they were received at the establishments they visited. The special film shows, held after the afternoon sessions in a hall near the Seymour Hall, were also successful. Those who were at the Guildhall Reception on the Wednesday evening will remember it as a memorable occasion, and the only regret is that the Conference had grown to such a size that the invitation list had to be closed, to the disappointment of a number of delegates.

Publicity

It has not yet been possible to count and analyse the Press and other publicity that was given to the Conference, which is of course an important factor to a body like the Society that is working to educate public opinion. But it can be said that it was excellent and more extensive than that from an ordinary conference. Leaders and editorial comments were published in many daily and technical papers, and also in publications outside the usual field of interest. Undoubtedly the most intriguing headline of all was that of the *Christian Science Monitor*, which headed an excellent report with " World Parley Pries at Smog Problem."

A.P.P.A.

We have received a copy of the second number of the new French journal on air pollution, the *Revue de l'Association pour la Prevention de la Pollution Atmospherique*. Its principal contents are articles on the influence of meteorological factors in air pollution, industrial air pollution, and a note on the immediate detection of carbon monoxide by means of an indicator described.

Fuel Efficiency Diary

We welcome once again the excellent diary that is published by H. O. Quinn Ltd., at 151 Fleet Street, London, E.C.4. The price is 13s. 6d., 11s. 6d. or 8s. 6d., according to binding. Edited by H. B. Locke, it contains a remarkable amount of practical information on fuels and their uses, together with the usual diary features.

Concluded from page 93

for which there is not yet a clear solution.

Mr. Brooke, Minister of Housing and Local Government, replying to the debate, pointed out that it was difficult to discriminate between one kind of mechanical stoker and another, but that the Order exempted only mechanical stokers installed on or after December 31st, 1956, when all new installations must, under the Clean Air Act, be so far as practicable capable of smokeless operation.

Address to the Conference

by

Sir Graham Sutton, C.B.E., F.R.S.

In the absence of the President, Sir Hugh Beaver, who was to have given his Presidential Address, the following address was prepared at short notice and read at the opening session of the International Clean Air Conference by the Senior Vice-President.

THIS address was to have been given by Sir Hugh Beaver. To step into Sir Hugh's shoes at short notice, as I have been asked to do, is an unenviable task, no matter what the subject. Sir Hugh has not only a vast experience of science and industry, but he invariably brings to any matter an inquiring and lively mind and expresses his thoughts in forceful English. I doubt very much if the Clean Air Act would now be the law of the land were it not for the energetic leadership which he gave to the Committee that made the nation-wide inquiry. I have the most vivid memories of the way in which he welded us into a team, and I am sure that I echo the thoughts of all here who know him when I wish him a speedy return to health.

This is the diamond jubilee of this Society, and diamond jubilees are a good excuse to pause and survey. There is a recurrent pattern in most good causes, for three needs must be satisfied before there can be effective action. First, people must be convinced that a real problem, calling for solution, exists. The pioneers in work such as that done by this Society must put up with being regarded as 'cranks' in the initial phase, but they can console themselves with the thought that many cranks end up by being revered as saints. This is the phase of propaganda. Secondly, there must be established a measurable basis for the activity—this is the phase of scientific activity, of which I shall say more later. Finally, there is the phase which I believe we have now entered, when the need is recognized, there is a respectable scientific basis for the work and technological means of curing the evil exist or can be devised. What remains is adequate legislation to put them into effect.

Sir Graham Sutton, F.R.S., Senior Vice-President

It was not easy, in the early years of this century, to convince the public, let alone the legislators, that dirty air is as much an evil as dirty water. In the North they had a saying 'Where there's muck, there's brass,' which perhaps I had better translate for the benefit of our overseas visitors as 'You can't make money without making a lot of dirt.' Many of the steel makers of Sheffield, I am told, cling fast to the belief that a really smoky atmosphere is necessary to make the steel for which that city is famous. But I think the battle has been won and that today no one is prepared to tolerate increasing pollution of the air.

As regards the scientific study of pollution, it is a curious fact that although men have observed and studied the atmosphere for centuries, real knowledge of its lowest layers is almost entirely a product of this century. The stratosphere, the cold, cloudless, remote upper layer of the atmosphere, was discovered at the end of the nineteenth century and for a long time remained virtually unexplored because of its inaccessibility. Yet prior to 1920 in some respects more was known about the stratosphere than the easily accessible lower atmosphere. It took a series of disastrous events to set in motion the studies on which so much of the knowledge that we possess is founded.

The pioneers in the systematic study of diffusion processes in the lower atmosphere were the Austrian meteorologist Wilhelm Schmidt, and the British scientists Sir Geoffrey Taylor (perhaps even today still better known as ‘ G. I. Taylor ’) and L. F. Richardson. Taylor’s work, which I think most meteorologists would agree is the most inspired and fundamental of all, began in the scientific investigations which followed the sinking of the liner *Titanic* as the result of a collision with an iceberg, during her maiden voyage across the North Atlantic. This disaster called attention to the need to study the movements of icebergs and the mode of formation of sea fog. Taylor sailed with the research ship *Scotia*, and in 1915 there was published his classical memoir on eddy motion in the atmosphere.

Turbulence

Smoke and gases, as you all know, are diffused in the lowest layers of the atmosphere as a result of the turbulence, or eddy motion, of the wind. It is not easy to define turbulence in precise language and I shall not attempt to do so here. It is sufficient to say that throughout the atmosphere, and especially near the ground, the wind exhibits not only a fairly steady average speed and direction, but also a fluctuating component of a random character. It is the fluctuations of the wind that tear a smoke cloud to pieces and dilute its originally high concentration. Without turbulence we could not live, for the same process is also the primary means whereby the watercycle is kept going and by which seeds and pollen are scattered.

I have referred to turbulence as a random motion, and at first sight it seems improbable, to say the least, that such a motion could ever be reduced to law. It was the great achievement of the three men whose names I have mentioned that they made the first break-through in this formidable problem. Taylor, for instance, in his studies of the fogs of the Grand Banks off Newfoundland, was able to show not only how they form and grow by the passage of warm wet air over cold water, but at the same time to give a reasonable quantitative theory of the process.

Yet even in 1915, if a meteorologist had been asked to state what concentration of smoke would be found at a given distance downwind of a known source in a stated wind speed, he could not have produced a satisfactory answer. Once again a disastrous event provided the impetus for further study. In the 1914-18 War gas was used for the first time as a weapon, often with dire results. When hostilities ceased, the defence authorities began to consider the scientific background to the use of this weapon, and in 1921 the Chemical Warfare Station was set up on Salisbury Plain to conduct such studies. Its field of investigation included the detailed study of the meteorology of the lower atmosphere, and it was here and at that time that micrometeorology was really born.

Sir Nelson Johnson

During the years between 1921 and the outbreak of the Second World War the lower atmosphere was studied more systematically and thoroughly at Porton than anywhere else in the world. I count myself fortunate to have been a member of the meteorology research team for part of this period, and I would like to pause here to pay a passing tribute to my old Chief, whom I succeeded as Director of the Meteorological Office, the late Sir Nelson Johnson. He was the first Head of the Meteorology Department at Porton. When he came to this work in 1921 practically nothing quantitative was known about the way in which smoke spreads from sources near the ground. Richardson had made some heroic and significant observations with data obtained from imprecise and crude observations ranging from the scatter of dandelion seeds to the results of a competition with toy balloons, but little else had been done. Johnson made the first really accurate measurements of the diffusion of smoke clouds, showing great ingenuity and skill in so doing, and he established the basic empirical laws. Without this background it is doubtful if we would be now in the position of being able to calculate, with tolerable accuracy, the spread of a smoke cloud in ‘ average ’ meteorological conditions.

Some of this work, in particular certain fundamental studies in meteorology, was published between 1921 and 1939, but the greater part remained as an ‘ official secret ’ until after the end of the Second World War. Since 1945 there has been a great deal of work done on the properties of the lower atmosphere, and the subject has become more systematized.

What did we learn as the result of the pre-war studies?

Perhaps the first and most important fact was that the low atmosphere is far more complex in its structure than had been realized in the early years of this century. In fact, many fundamental problems still remain to be solved. On the credit side, however, there was much to show. First, we began to understand (and to a certain degree to explain qualitatively) the fundamental part played by the temperature structure of the atmosphere in controlling turbulence. This feature, which is almost impossible to reproduce on the laboratory scale, makes the task of the mathematical physicist extremely difficult when it comes to formulating a reliable mathematical theory of diffusion process in the atmosphere. In plain English, it became possible to predict with tolerable accuracy what happens to a smoke cloud emitted under an overcast sky with a moderate or high wind, that is, when the vertical gradient of temperature is small, but, even today, we have no completely reliable means of estimating the increase in concentration which results when the turbulence of the wind is checked by the formation of an inversion, for example, under clear night skies or with a winter anticyclone. Yet this is the condition of potentially greatest peril to those who live in polluted areas.

Heated Plumes

Some of the most interesting work that has been done in the post-war period relates to the dynamics of heated plumes. The first solution of the problem of the rise of hot air from a source of heat was given by Schmidt in 1941. I gave another solution, which is more amenable to computation than Schmidt's, and seemed to fit the laboratory experiments rather more closely, at the United States Conference on Air Pollution in Washington in 1950. These solutions referred to the rise of a plume of warm air in a calm, neutrally stable, atmosphere. In the same paper I gave a first approximation to the solution of a far more difficult and, for the purposes of pollution studies, a more important problem, namely, to calculate the path followed by a plume of hot gas which is not only rising under its own buoyancy but is also blown sideways by the wind.

The study of such problems not only provides the mathematician with some fascinating and formidable problems, but is essential for any quantitative solution of the problems which beset the designers of industrial plants. It is well known to all here that to avoid high concentrations of unpleasant or noxious gases in the vicinity of an industrial plant the golden rule is ‘ Keep the stack orifice and the temperature of the effluent high.’ But how high, and how hot? We must be able to give reasonably accurate answers if we are to provide the engineer with something better than pious exhortations to do better than his predecessors.

Some interesting and important work has been done in Cambridge and in Australia on these problems. First, as regards the rise of smoke in a calm atmosphere in which temperature changes with height. This has been studied by Morton, Taylor and Turner in Sir Geoffrey Taylor’s laboratory and in Australia by Priestley and Ball working in the Division of Meteorological Physics of the Commonwealth Scientific and Industrial Organization. Their results, which are in reasonable agreement, show that in a calm ‘ average ’ atmosphere, the amount of heat generated at the source must be very greatly increased to change the height reached by the plume by a substantial amount. Thus, in such an atmosphere, smoke from a household chimney would reach about 200 feet, and the smoke from a large power-station chimney, about 3,000 feet. But the ratio of the heat sources is about 60,000!

The problem of the rise of a heated plume in a calm atmosphere is perhaps somewhat academic in relation to the real problems of atmospheric pollution. The case of greatest interest is that of the bent-over plume, when wind and buoyancy to some extent act against each other, although in the end each contributes to the desired dilution. This problem is much more difficult and a really satisfactory solution is yet to seek. The problem for the pollution engineer may be put thus. Because of its buoyancy the plume rises and ultimately it becomes nearly horizontal, travelling downwind at a height greater than that of the stack from which it came. The effect of the hot source is thus to give the stack a greater “ effective height.” Any increase in height has a considerable beneficial effect on concentrations of smoke at ground level downwind of the stack. It is a curious fact that although there are several different formulae expressing this effect, which look very dissimilar on paper, they give results which do not differ too widely when they are applied to the prediction of concentrations near the ground, which is what really matters to the engineer or architect.

In the Beaver Committee Report we adopted a simple empirical expression derived by the American meteorologist J. Z. Holland from observations on plumes at Oak Ridge, Tennessee. In the present state of the art this is probably as good as any, especially when it is realized that it is only occasionally that the relevant factors, heat output, wind speed and temperature gradient in the ambient atmosphere, will be known accurately.

Earlier I pointed out that the actual height reached by a plume in a calm atmosphere increases only slowly with an increase of heat at the source. This, however, should not be taken to imply that there is little point in conserving heat in a stack. Because of the marked effect of increase of stack height on ground concentrations—as the inverse square of the height—any lifting of the plume is desirable. The golden rule I stated earlier thus still holds, but now we can in many cases put figures into it.

Effect of Tall Buildings

The practical problem, however, does not end with the calculation of the effective height of the heated plume. Mathematicians can work only with ‘ ideal ’ problems and in the examples quoted above it is assumed that the smoke gets away from the stack orifice without hindrance. In our cities the tendency today is to build tall buildings with cliff-like structure. (There is a good example of this type of building now going up near Waterloo station on the South Bank of the Thames.) With such buildings the natural wind is likely to form strong lee eddies near the roof, which cause a strong downwash from the flat roof. Any effluent emitted at roof level may be forced down the lee side of the building, thus producing high concentrations at ground level.

Problems such as these are not amenable to calculation and are best examined by tests with models in wind tunnels. The simplest solution would be to provide a tall ‘ chimney pot ’ in the form of a stack mounted on the roof, so that the orifice is placed well above the region of disturbed flow, but usually this is unacceptable on architectural and aesthetic grounds. Fairing of the roof by the provision of sloping sides can also be of some assistance, but any pronounced departure from the flat roof is again unwelcome to most architects. Heating of the effluent alone is unlikely to provide a practical solution and the only way to overcome the difficulty appears to be to use a strong forced draught. In some tests recently carried out at the National Physical Laboratory for a building about 300 feet high it seems that the ratio

$$\frac{\text{exit speed}}{\text{wind speed}}$$

should lie between 2 and 3. For central London this indicates that the exit speed of the gases should not be less than 70 ft./sec. (about 22 metres a second). This illustrates the kind of problem facing heating engineers who have to use oil- or coal-burning plant for a large building about 300 feet high.

The primary aim of this Conference is to discuss practical means of overcoming the evil of air pollution. I have dwelt at some length on the theoretical work which has gone on behind the scenes, as it were, because practical men can do little without figures, and it is the job of the scientist to supply the figures. As in all problems which bring in the atmosphere, it is vain to hope for great precision or accuracy. The number of variables is so great that any planning must be on a broad basis. What is essential is that the planning is reliable, and this brings us back once again to the scientists whose duty it is to establish a firm foundation.

Last year I attended an international conference on atmospheric diffusion at Oxford, and before that, in 1951, I had taken part in a similar conference at the Massachusetts Institute of Technology. It was interesting to compare the two. In 1951 most of the papers dealt with instruments and observations on atmospheric turbulence. In 1958 the mathematicians had got well on top and it looks as if they intend to stay there for a long time. In the early years of this century the subject looked very simple. Now it is so complicated that it needs a great deal of hard work and considerable technical skill to understand what the mathematicians are talking about, let alone consider practical applications. But that always happens when you let mathematicians in.

The Cure for Pollution

I make no apology for my fellow mathematicians in this matter because I know that their labours will not be wasted. The cure for pollution is simple—don’t put nasty substances into the air. The studies which have been made on methods of eliminating, or greatly reducing, noxious products have, I believe, reached the stage at which we may say that the problem can be solved in most, if not all, cases. But this is a matter for the fuel engineers and I have no doubt that it will receive much consideration in your discussions.

It is heartening that at this stage in the history of the Society we can look on its labours with such satisfaction. The fact that you have gathered here, and in many instances travelled long distances, to discuss ways of overcoming one of the great evils of our age is also most heartening. It shows that we have a care for our neighbour. This great city was once notorious for the awesome character of its smoke-laden fogs and only seven years ago we had a painful reminder of the deadly nature of pollution. We still have our fogs and, as far as I can judge, they will be with us for ever. What we are justified in hoping is that never again will London suffer from the folly of man in poisoning his own air.

The programme in front of you is wide and interesting. ' No man is an island ' said Donne, and that might well be the keyword of this Conference. I wish you well in your deliberations.

Correspondence

Two Views on the Conference

To the Editor,
Smokeless Air.

Sir,—Last year I attended the Llandudno conference and I expressed in no uncertain terms that this was probably the best conference I had ever attended, so good was the discussion and so controlled was the time of the speakers taking part. I write to express a personal opinion on the conference held last week in London. This is fortified by opinions expressed to me by many other delegates I spoke to and my point in writing is that the Society will not be solely satisfied by the numbers present and the distances travelled.

I felt that so far as the majority of delegates were concerned, they formed an audience for scientists to express their views on matters which were " way up in the sky." Hardly at all did the conference come down to the local authority problems of today at a time which is critical in the promotion of smoke control areas and the solution of present-day *practical* problems in industry.

Many local authorities are at present in the first stages of the above problems and I personally regret that not only were they not discussed in detail but the opportunity of national publicity for the present-day *domestic* and *industrial* problems of which we want as much as possible, was lost.

I do hope you will treat these sentiments in the way they are given, as having a very great interest in clean air, I have come back from the conference very disappointed, particularly after last year's most excellent one at Llandudno. By next year we shall have had to solve many of our practical day-to-day problems ourselves and I feel that the 1959 conference could have helped us, but, alas, it hasn't. I would have said, by all means have the scientists there, but let them discuss their problems separately and let local authorities get on with discussing present pressing problems.

Yours, etc.,
W. JENNINGS

Brighouse, Yorks.

The Editor,
Smokeless Air.

Sir,—As an Individual Member may I say how much I enjoyed and how profitable I found the recent international conference. This was one of the most stimulating conferences I have ever attended and, from my point of view, part of its success lay in the extremely diverse groups of interests which were represented. These ranged from M.o.H.'s, Public Health Inspectors and other professional staff, representatives from many Council and front ranking scientists and technologists of many nationalities from most of the expert fields which have direct or indirect bearing upon the problems of clean air.

It is only on very rare occasions that such a comprehensive cross-section of persons dealing with almost all aspects of one of the many possible examples of the impact of technological developments upon our personal lives had this opportunity to meet together. As an individual who is not immediately concerned with advancing technical knowledge in this field or with the implementation of the Clean Air Act, perhaps I am permitted to hold a more detached point of view than either of these two major groups. Indeed, to me one of the most important aspects of the conference, as opposed to the very fine collection of technical and scientific papers, which could be assimilated alone, was the clear expression of distinctive and, at times, even conflicting attitudes of mind between different major sub-groups. This I would refer to as a natural conflict between the legitimately different interests of (certain members of) these groups.

It stresses in my mind the fact that logical argument is perhaps not the first line of attack for pressing home the implementation of the Clean Air Act and that much more attention should be focussed upon legitimate differences of interest in attitude and methods of changing these. If such differences of interest were evident amongst persons drawn together by various forms of common concern for clean air, how much more is a conflict of interest to be assumed as a starting point in the " human relations " problems of the local authority concerned with the immediate social and administrative aspects of the Clean Air Act? This is just one of the many psychological problems arising out of the recent conference which interested me personally.

Yours, etc.,

ROLAND HARPER, M.SC., PH.D., F.B.PS.S.

Leeds.

Disposal of Garden Refuse

The Editor,
Smokeless Air.

Sir,—It was interesting to read on page 29 of the Autumn number of *Smokeless Air* that Birmingham is to introduce a scheme whereby garden refuse is to be removed for a small payment by the salvage department at the same time as domestic refuse is collected.

In August, 1958, as a contribution to the reduction of atmospheric pollution, a scheme was introduced in Doncaster by the Health Department (which is responsible for refuse collection) for the *free* collection of burnable garden refuse. Small amounts are dealt with along with the domestic refuse. Large amounts, or material such as tree loppings are removed by a special collection by appointment. For the latter, an open lorry was found preferable to the special types of refuse collection vehicle.

The scheme has been very successful, although some people's idea of what is burnable can be original, and stones, bricks and sods in bins have caused a few problems! In the first nine months it was estimated that more than 400 tons of burnable material were removed. This year, with the service becoming better known, the amount was increasing and the possibility of having to provide extra vehicles and men may have to be considered.

In view of the economic factors involved, there is undoubtedly scope for education of the public living in houses with a garden to compost all non-woody garden waste and all organic kitchen waste and ashes.

Yours, etc.,

H. L. SETTLE (*Lately Medical Officer of Health, Doncaster C.B.*)

Fulham.

Not Standard

The Editor,
Smokeless Air.

Sir,—May I be permitted to draw your attention to an inaccuracy in the illustration appearing on page 28 of your issue for Autumn 1959?

The caption describes the instrument illustrated as a " Standard Deposit Gauge." It is, in fact, a gauge modified at the Warren Spring Laboratory in order to demonstrate several variations from the standard instrument, which experience has shown might be incorporated to cope with special requirements. For example, the securing framework depicted for the plastic 10-litre bottle was designed to keep the bottle from displacement by wind and to render it thiefproof, and is not a fitment obtainable from the usual commercial sources as part of the standard gauge, as your readers might be led to suppose.

Yours, etc.,

S. R. CRAXFORD

Warren Spring Laboratory,
Stevenage.

SMOKE CONTROL AREAS

Progress Report

POSITION TO 30th SEPTEMBER, 1959—TOTALS

	England and Wales	Scotland
Smokeless Zones (Local Acts) in Operation	44	1
Acres, 3,400		
Premises, 41,060		
Smoke Control Areas in Operation	70	1
Acres, 9,144		
Premises, 61,160		
Smoke Control Orders—		
Confirmed	80	3
Submitted	87	1
Proposals Notified	216	10
Not Confirmed (*Deduct*)	1	
Grand Totals	496	16

The lists given below are supplementary to the information in the last issue of *Smokeless Air* (Autumn, 1959), which gave the position up to July 31st, 1959. They now show the changes and additions to September 30th, 1959.

Some of the areas listed are new housing estates, or areas to be developed for housing. The total number of premises involved will therefore increase. An asterisk denotes that there have been objections and that a formal inquiry has been or will be held.

ENGLAND AND WALES

New Smoke Control Areas in Operation

Aireborough U.D. No. 1, Basildon U.D. No. 1, Bedford B. No. 1, Dagenham B. No. 1, Dewsbury C.B. No. 2, Ellesmere Port B. No. 1, Hackney M.B. No. 1, Hampstead M.B. No. 1, Hayes and Harlington U.D. No. 6, Holborn M.B. No. 1, Hornchurch U.D. No. 1, Leamington Spa B. No. 2, Leicester C.B. No. 2, Lewisham M.B. No. 1, Liverpool C.B. Nos. 5 and 6, Rotherham C.B. No. 3, St. Pancras M.B. No. 1, Shoreditch M.B. No. 1, Smethwick C.B. No. 1, Tottenham B. No. 1, Wandsworth M.B. No. 1, Wortley R.D. No. 1.

New Orders Confirmed but not yet in Operation

Aireborough U.D. No. 2A, *Bebington B. No. 1, Denton U.D. No. 2, *Hendon B. No. 1, Wednesfield U.D. Nos. 1, 2 and 3, Whitefield U.D. No. 1.

New Orders Submitted for Confirmation but not yet Confirmed

Aireborough U.D. No. 3, Altrincham B. No. 1, Barnet U.D. No. 1, Barnsley C.B. No. 1, Bermondsey B. No. 2, Bootle C.B. Nos. 1 and 2, Bury C.B. No. 1, Chadderton U.D. No. 1, Deptford M.B. No. 1, Greenwich M.B. No. 1, Hayes and Harlington U.D. Nos. 12 and 14, Hyde B. No. 1, Islington M.B. Nos. 1 and 2, Knottingley U.D. Nos. 2 and 3, Leamington Spa B. No. 3, Leicester C.B. No. 3, Liverpool C.B. No. 9, Luton B. No. 1, Pontefract B. No. 1, Reading C.B. No. 2, Rotherham C.B. Nos. 4 and 5, Salford C.B. No. 3, S.E. Derbyshire R.D. No. 3, Stalybridge B. Nos. 3 and 4, West Bromwich C.B. Nos. 5 and 6, Woolwich M.B. Nos. 5 and 6.

Proposals Notified to the Minister

Aireborough U.D. Nos. 6, 7 and 8, Brierley Hill U.D. No. 10, Chadderton U.D. No. 2, Chesterfield B. Nos. 1 and 2, Church U.D. No. 1, Crayford U.D. No. 1, Ellesmere Port B. Nos. 2 and 3, Erith B. No. 1, Gateshead B. Nos. 1 and 2, Hampstead M.B. No. 3, Hornchurch U.D. No. 2, Newburn U.D. No. 1, Newcastle-upon-Tyne C.B. No. 2, Penge U.D. No. 1, Richmond (Surrey) B. No. 1, Rotherham C.B. Nos. 9 and 10, Runcorn U.D. No. 1, Southall B. No. 2, Spenborough B. No. 1, Stretford B. No. 1, Tottenham B. No. 2, Whickam U.D. No. 1, Whitefield U.D. No. 2.

SCOTLAND

New Smoke Control Areas in Operation

Nil.

New Orders Confirmed but not yet in Operation

Dumbarton.

New Orders Submitted for Confirmation but not yet Confirmed

Coatbridge.

Proposals Notified to the Minister

Dumbarton No. 2, Dundee No. 2, Glasgow Nos. 1, 2 and 3.

CLEAN AIR ACT CASES

Section 1—Leeds

The National Coal Board—the first defendant to be prosecuted under the Clean Air Act in Leeds—pleaded not guilty to four offences relating to emissions from Middleton Broom Colliery, Belle Isle, Leeds, in the City Court, September 24th. After hearing the case for the prosecution, the case was adjourned until November 5th.

Section 1—Uxbridge

In the first case under the Act to be brought before the Uxbridge magistrates R. Woolfe & Co. (Rubber) Ltd. were given a conditional discharge with payment of 3 guineas costs for permitting an emission of dark smoke from an incinerator chimney. At the time the company were using coal but since they had changed over to oil fuel.

Section 16—Barnet

Messrs. Tonis Cream Ices Ltd. were fined £5 with 5 guineas costs at Barnet Magistrates Court on August 19th for causing a nuisance to householders in the area of their factory by burning cardboard carton waste which gave off dark smoke and an offensive smell.

First Case at Castleford

The town clerk has been authorised to prosecute a local firm under the provisions of the Clean Air Act for permitting the emission of dense clouds of dark smoke for more than 20 minutes.

Section 20—Liverpool

In the first case to be brought before the Liverpool Magistrates Court under the Act, North West Tugs Ltd. were fined £3. The company pleaded guilty to the charge alleging that black smoke was emitted from their vessel *Game Cock V* for 15 minutes.

Section 1—West Bromwich

Mathews Oils Ltd. were fined £5 for emitting smoke from a chimney on August 5th for a period of 62 minutes. A representative of the firm said the boiler had to be started with coal before coke was burned and on the occasion in question the furnace had been allowed to die out and they were in the process of relighting it quickly.

Section 1—Sheffield

Cocker Bros. Ltd. were fined £10 for emitting dark smoke for a period of 22 minutes in an observation period of half an hour.

Barnsley Firm Ignore Dust Warnings

John Hinchcliffe & Sons Ltd., tar macadam manufacturers were summoned for failing to comply with a notice to abate the dust nuisance arising from their operations. They had been approached thirty times by the local authority representative but had so far done nothing to put the matter right. The case was adjourned for five months to allow the firm to install machinery to collect the dust.

COKE BURNING APPLIANCES

New Edition of Handbook

In April last the Gas Council and the National Coal Board were invited to take over from the Ministry of Power the testing and approval of domestic solid fuel appliances. Following this arrangement the Domestic Solid Fuel Appliances Approval Council was formed.

The results of appliance type-testing in the Coke Appliances Laboratories of the Gas Industry are now made available to the new organization to enable them to continue the publication of the list of names of " Approved Domestic Solid Fuel Appliances."

The extension of Smoke Control Areas to all parts of the country has increased the demand for reliable information on efficient coke-burning appliances for replacement purposes and new housing schemes.

This new edition of the Handbook, which continues to be produced by the Gas Council's Coke Department, gives full specifications on all suitable appliances.

Details of over 400 tested and approved solid fuel appliances are contained in the Handbook, which is illustrated with photographs and diagrams. Full technical information on each appliance, including the heat service, is given on data sheets. The book is divided into sections for the various types of appliances, and each section is preceded by introductory notes of technical interest and value. Reference is made at the beginning to the conditions and procedure for approval of appliances and details on suitable sizing, densities and calorific values of coke are given.

The new Handbook provides a useful guide, and simplifies the choice of appliances for all those concerned with their selection and installation. Prepared in convenient loose-leaf form, to enable additional information to be added, the Handbook is obtainable from Area Gas Boards and the Gas Council Coke Department, at the price of 35s., which covers the supply of supplementary information.

British Standard Specification for Open Fire Coke. (B.S. 3142: 1959).

The British Standard Specification for coke to be used in the modern domestic open fire has now been issued. This specification is the first of its kind and is the first part of a proposed wider specification which it is hoped will eventually include sections dealing with coke for closed domestic appliances and reactive smokeless fuels. The specification is based on quality control and deals with coke up to the point of dispatch from producers works.

The standard specifies two types of coke, i.e. L, usually of bulk density below 23 lb./cu. ft. and M, bulk density above 23 lb./cu. ft. They are similar in quality but differ in combustion characteristics. Generally, type L will ignite more easily but the fire will require more frequent replenishment than with type M coke.

The quality is assessed in the specification by determination of moisture, size and performance on an open fire, carried out on daily samples. The results from these daily samples are examined on a weekly basis and each property is specified by a mean value and limiting values which must not be exceeded by more than 2·5 per cent. of the daily determinations.

GAS INDUSTRY PROGRESS

Council's Tenth Report

Tenth Annual Report of the Gas Council, 1958-59. H.M. Stationery Office, London, 10s. 6d. net.

For the first year since vesting date the Gas Industry has to report a deficit. Due to the industrial recession, relatively mild weather and increased costs overtaking charges, the deficit of £1·4 m. is about 0·3 per cent. of the gross income of £389 m. More important is the increase in efficiency and the many developments of importance for the future that the report discusses. It is interesting to note that the increase in efficiency since vesting date has reduced coal requirements by the equivalent of 2½ m. tons a year, with an annual saving of £15 m.

The policy of concentrating production at the larger and more efficient works has continued and there are now 463 manufacturing works in use, compared with 1,050 at vesting date. On the business side the continuing integration of gas production and distribution has led to a greater degree of central control in some Area Boards, with simplification of management and improved service to consumers. Some Boards have been able to effect economies from the adoption of centralized billing and the introduction of electronic accounting equipment.

Among the developments of importance is the arrival of the first trial cargo of liquefied natural gas, which arrived at Canvey Island, Essex, in February, 1959, and was successfully discharged into storage tanks. After

" Methane Pioneer," the vessel which brought to Canvey Island, Essex, the first load of liquid natural gas ever to be transported by sea

Regent Court Flats, Gateshead, incorporating Se-Duct flues. Each flat is provided with an instantaneous multi-point gas water heater, a gas-fired clothes drying cabinet, gas cooker, wash-boiler and convector gas fire in the living room

being gasified at Canvey, it was piped to the Romford Works where it was reformed and distributed to consumers in the area of the North Thames Gas Board. Two more trial voyages have been successfully completed and further voyages are to be made. Consideration is now being given to the technical and economic aspects of importing on a large scale.

Natural Gas and Underground Storage

The results of the search for natural gas have been disappointing, and after a reassessment during the year the Council has decided to continue the search on a limited scale. The Scottish Board is continuing to take a regular, although small, supply of natural gas into its works at Musselburgh from the well at Cousland. It is mixed with manufactured gas and distributed through the ordinary supply system. The reserve at Cousland is not known, and it is thought that it may be as much as 3,000 m. cubic feet or as little as 250 m. cubic feet. Another reserve of natural gas has been proved at Calow in Derbyshire. The size is thought to be small but no reliable estimate can be made without the drilling of a further well, which is to be done.

The Council has decided to extend the scale of its investigation into the possible geological formations in the country suitable for the storage of gas underground. The economics of underground storage, particularly when it is linked to a national grid system, are attractive, as such storage facilities would enable gas manufacturing plant to be worked on base load, gas being pumped into the reservoirs during the summer and withdrawn during the winter months when demand is greatest.

New Processes

Site preparation work is well

advanced for a plant to hydrogenate oil or coal at high pressure which is to be installed at the Partington works of the North-Western Gas Board. This is a process developed at the Midlands Research Station, and as is inevitable with a new conception, delays have occurred in the design of the plant for the first stage of the development, which is the hydrogenation of oil. The ultimate objective of the experiment however, is a process for the hydrogenation of coal, and when the plant has operated successfully on oil it will be adapted to use coal. It may not be economic to hydrogenate coal completely, and it may prove preferable to carry out only the initial rapid hydrogenation leaving a coal char which must of course be used. A tentative scheme is to gasify this with oxygen-steam in order to obtain the necessary hydrogen.

The construction of the Lurgi high pressure complete gasification plant for the Scottish Board at Westfield, Fife (described in *Smokeless Air*, No. 106, Summer, 1958), has begun and the first section from Westfield to Dunfermline, of the high pressure pipeline associated with the project was completed. The West Midlands Board received planning permission for its proposed Lurgi plant at Coleshill, near Birmingham, and the Minister of Power has approved the project in principle.

Coke

Coke production during the year was 10·9 m. tons, compared with 11·8 m. the year before, plus 2·6 m. tons of breeze. Coke sales totalled 9·2 m. tons, as against 9·6 m. the year before. The report states that in common with other producers of solid fuels, the industry was facing the problem of a selective buyers' market. Output of gas coke was in excess of demand and stockpiling continued. The increased demand for smokeless fuels expected to result from the Clean Air Act will certainly come, continues the report, but progress under the Act is relatively slow.

All the Boards operated a summer/winter price scheme to encourage the summer stocking of coke and relieve the heavy winter pressure in distribution, but it is admitted that the scheme did not transfer much of the winter load to the summer.

The report discusses the British Standard for open fire coke that has just been published. The specification provides for two classes of gas coke of high quality—type " L " applicable to cokes produced from continuous vertical retorts and type " M " to cokes from static retorts. " In preparing the standard," says the report, " it has been recognized that coke should be as constant as possible in quality. Because it is impossible to guarantee that every part of a delivery of coke to the domestic market will be identical and conform to a rigid specification the standard is based on quality control at the point of production. Area Boards have for some months established regular control testing at some 45 of their largest works in order to obtain experience of operation of the proposed standard."

The Merchants of Smog

Sparked off, it would seem, by the account in our last issue of the anti-clean air activities of the coal trade, the *Observer* (November 15th) published a front page account of the trade's plans for further efforts. It was headed " Curb Smoke Laws, says Coal Trade," and described the £25,000 per annum organization that has been set up to attempt to restrict the number of what are termed " unnecessary " smoke control areas. From a spokesman of the Coal Merchants' Federation the *Observer* was told that they have already lobbied the fuel committees of the Parliamentary Labour and Conservative Parties and intend to review the national campaign in January.

We shall return to this subject again, and in the meantime would be glad if our local authority readers would keep us informed of local activities aiming at sabotaging action under the Clean Air Act.

ELECTRICITY IN ENGLAND AND WALES

First C.E.G.B. Report

Central Electricity Generating Board. First Report and Accounts, January 1st, 1958-March 31st, 1959. H.M.S.O. 10s. 6d.

The Electricity Council, with supervisory powers over the whole electricity industry, and the Central Electricity Generating Board, came into being on January 1st, 1958, under the provisions of the Electricity Act of 1957.

The first report of the Generating Board indicates that a measure of authority has been delegated to five Regions into which the eleven Divisions of the Board have been grouped. Each Region is responsible for the operation of generating stations and of the grid to the requirements of National Control and also the design and construction of certain capital works.

The industry has continued to expand, the total sales of electricity having increased from 79,678-84,497 million units while the average price per unit sold has increased from 1·023d. to 1·0269d. per unit. The maximum output capacity of power stations has increased from 22,343,000 to 23,400,000 kilowatts and the thermal efficiency of generation has risen from 25·51 to 26·10 per cent., and at the same time the works cost of generation has fallen from 0·666d. to 0·645d. per unit. The grid has been extended from 5,978 to 6,337 miles.

During the year 1,124,000 kilowatts of new plant was brought into commission. For the years 1959-64 it is planned to install new capacity exceeding 12,300 M.W. in 25 new power stations, in eight new stations partly in operation, and five new sections of power stations. Five of the new stations will be nuclear—Berkeley, Bradwell, Hinkley Point, Trawsfynydd and Dungeness.

The grid is also being extended. A further 1,000 miles of the 275,000 volt grid is planned and new grid points of supply to Area Boards will be provided.

Fuel Policy. In 1954-5 when it appeared that the requirements of power stations would exceed the available coal supplies, it was decided to adopt nuclear power as a long-term policy to meet the deficiency, while the short-term fuel gap would be met by fuel oil. This policy has been modified as the result of the change in the national fuel situation and the unexpected surplus of coal suitable for power generation. New large coal-burning and nuclear power stations are generally situated in areas remote from centres of population and the grid serves for large scale bulk transmission. In constructing the grid the Board pays great attention to the amenities of the countryside; but realizes that the grid may at times contribute something to the defacement of an area. The Board points out, however, that an underground cable to transmit at 275,000 volts would cost some £300,000 to £400,000 a mile as against £25,000 per mile of overhead line, apart from the introduction of technical difficulties.

The development and modernization of plants continues. The number of separate stations decreased during the year from 291 to 238. The number of stations with an installed capacity of less than 10,000 kilowatts fell from 140 to 42 while stations of a capacity greater than 320,000 kilowatts increased from nil to 16. 424 generating sets or 18·2 per cent. of total installed capacity were 25 or more years old and 258 sets, 3·6 per cent. of total capacity had individual capacities of less than 8,000 kilowatts as compared with present-day units of

120,000 kilowatts that are being installed. Sets up to 550,000 kilowatts at 2,300 lbs. per square inch and 1050 F/1050 F reheat are envisaged. Generators with water-cooled stator windings and with hydrogen-cooled stator and rotor windings continued to operate satisfactorily. The 300 M.W. pumped storage scheme at Blaenau Ffestiniog is under construction. Trials of plant for the generation of electricity in conjunction with gas generated by underground gasification of coal have been discontinued.

Clean Air. From June 1st, 1958, power stations are scheduled under the Alkali Works Regulation Act 1906. The Board continues, says the report, to give attention to the avoidance of atmospheric pollution. Increasing quantities of low grade fuel are being used and power station plant is designed to burn this efficiently, and attention is being given to grit arresting plant. Flue gases are discharged from tall chimneys 350-450 feet high usually at a sufficiently high velocity to penetrate fog or inversion layers. Evidence of this was obtained by aircraft flights over fog during the winter of 1958-59. Surveys of dust and sulphur dioxide pollution were made around 76 power stations involving 379 measurements of dust deposits and 357 measurements of sulphur dioxide each month.

Cross-Channel Cable. It is anticipated that a saving of plants in France and England will be realized by this interconnection, from the fact that peak demands in the two countries are not coincident. Operation will be at 200,000 volts—100,000 volts with a transmission capacity of 160,000 kilowatts. Design work for the submarine cable and converter substations is proceeding in conjunction with Electricité de France.

The income of the Board arising from sales of electricity to area Boards amounted to £361 million, 6·2 per cent. above the previous year. Expenditure was £350 million of which fuel amounted to 54·7 per cent. and capital charges (mainly interest on capital and depreciation) to 25·6 per cent. The operating surplus of £10,762,488 was lower than the corresponding figure for 1958, but this was accounted for by an additional sum of £5·9 million charged to depreciation under a revised system.—*A. J. C.*

(*The first Annual Report of the new Electricity Council has also been received and will be reviewed in our next issue.*—Ed.)

The smoky travelling crane, as on the left, is a frequent problem. On the right is a new type of smokeless, diesel-powered crane

THE DEVELOPMENT OF NEW SMOKELESS FUELS

by J. BRONOWSKI, M.A., Ph.D.

Director-General of Process Development, National Coal Board, Great Britain

A Paper Presented at the International Clean Air Conference

THE towns of this country intend to get rid of their smoke: they have public opinion to back them, and the statute book to give them the power to act. The change will be far-reaching, as the Beaver Committee[1] showed; for example, the committee agreed that no fewer than 19 million tons of coal which are burned every year in houses in black areas will have to be replaced. When the committee reported, five years ago, it thus laid bare the size of the change which this country will have to make, but of course it could not forecast how the change would be made—what smokeless fuels the public would choose. An instructive thing that has happened since then has been the movement of public demand for the various smokeless fuels through four successive winters. This is the one piece of evidence that has been added since the Beaver Committee reported: we now see how public demand has begun to change. This evidence of the market place is beginning to point towards a policy for the development of smokeless fuels.

The one thing that everybody has heard is that householders have been buying oil and paraffin in place of coal. This is, however, a superficial assessment of the change in the habits of householders. What has happened is that householders have already been buying more smokeless fuel, and oil is one of the fuels that they have been buying. Table I gives the sales, in the four complete years since the Beaver Report was published, of the four kinds of smokeless fuel between which the public can choose—that is, electricity, gas, solid smokeless fuels and oil.

The trends in Table I are unmistakable. There has been a firm increase in the household use of electricity and of oil: oil has made the larger gain, having risen over 60 per cent in four years. (The home use of electricity, of course, includes lighting and some power as well as heating.) By contrast, gas and the solid smokeless fuels have at best stood still. From these overall figures, I will draw for the moment only one rudimentary lesson. It is this: that whatever the public has been looking for, it has not been looking for the cheapest smokeless fuel—for the cheapest of these four sources of heat are some of the solid smokeless fuels.

There are more subtle lessons hidden in Table I and, in order to find them, we must look to see how its figures are made up. Electricity is all one kind of fuel, and so is gas one kind, and oil that is used in the home is in the main of two kinds only. But the solid smokeless fuels are less homogenous both in use and in quality. First, there are smokeless fuels that are burned mainly in closed stoves, and there are others that are burned mainly in open grates—either in stool-bottom open grates or in improved modern open grates. Second, for each of these uses there are fuels of different qualities, which offer the householder different amenities in addition to the crude heat which they give out. I am concerned in this paper

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[1] Report of the Committee on Air Pollution (Chairman: Sir Hugh Beaver), November 1954, H.M.S.O. (Cmd. 9322).

Table I

Sales of Smokeless Fuels for Household Use from 1955 to 1958

Fuel	1955	1956	1957	1958
Electricity (TWh)	20·0	22·4	23·4	26·6
Gas (million therms)	1,361	1,347	1,310	1,320
Solid Smokeless Fuels (million tons) ..	5·6	5·6	5·2	5·6
Oil (million tons)..	0·8	0·9	0·9	1·3

only with premium fuels of high quality, and therefore I shall extract from the total figure for solid smokeless fuels in Table I the figures for the sales of the premium fuels. In Table II, I present the sales of premium fuels for the open fire in the four years since the Beaver Report was published, and in Table III I present the figures for the sales of premium fuels for closed stoves in the same years.

The figures in Tables II and III are striking. For Table I seemed to show that the sales of the solid smokeless fuels in the last four years had been stationary; but now we see that there has in fact been a first movement in public demand. The sales of all the premium smokeless fuels, for the open fire and for closed stoves, have been rising quite rapidly. The percentage rise in the sales of premium fuels for the open fire in four years has been over 70 per cent. This is greater than the rise in the household sales of oil, and is the largest rise of any smokeless fuel.

We must not read too much into Tables II and III—or, for that matter, into Table I, in which the oil figures have hitherto had all the public attention. The quantities of smokeless fuel which are being sold are still quite marginal: less than a million tons of premium fuel for the open fire, 1·3 million tons of oil (equivalent to 2·2 million tons of coal in heat content), and just under 2 million tons of premium fuel for closed stoves. Neither singly nor in total do these

Table II

Sales of Premium Smokeless Fuels for Open Grates from 1955 to 1958

Fuel	1955	1956	1957	1958
Premium Smokeless Fuels for Open Grates (in thousands of tons) ..	468	496	568	788

The premium fuels listed include Coalite, Rexco, Cleanglow and Phimax.

Table III

Sales of Premium Smokeless Fuels for Closed Stoves from 1955 to 1958

Fuel	1955	1956	1957	1958
Premium Smokeless Fuels for Closed Stoves (in thousands of tons) ..	1,616	1,767	1,794	1,922

The premium fuels listed include Anthracite, Phurnacite and Welsh Dry Steam Coal quantities compare with the 30 million tons of house coal that is sold. Moreover, we have not yet felt the impact of the Clean Air Act in any force: the main body of local legislation to forbid the making of smoke will come some years from now. Therefore the changes which Tables II and III record are voluntary changes; they represent the choice of consumers who are free to choose, and who on the whole can afford to choose what they like best.

Nevertheless, we must accept the evidence of Tables II and III as the first expression of a deliberate choice by a part of the public. This part of the public prefers the premium fuels, in closed stoves and in open grates. What is important here is not the absolute quantities that it has been buying, but the increase in these quantities from year to year; in effect, this part of the public has been buying each year as much of the premium fuels as it can get. And in doing so, it has not been deterred by their price. Some of the premium fuels which have recorded the largest rise in sales cost in London £12 a ton and more, which works out at more than 10d. a therm. Of course the heating bill is a small item in the household budget—it is the smallest single item in the official estimate of the cost of living. Nevertheless, these consumers could keep their heating bills lower by using other than premium fuels; and it is therefore striking that they should, in large numbers, have begun to move to the premium fuels year by year now.

At least a part of the public has been expressing preferences which are not dictated by price, and which must therefore reflect something else; something which it calls, in the most general way, convenience. That word has become something of a catchword, and it is important to analyze what this public finds convenient. It seems to me that there are three phases of convenience in a solid fuel. It must be convenient before we burn it—that is, convenient to handle and to store. It must be convenient when we burn it—that is, in an open fire it must ignite easily, burn brightly and long, and pick up well whenever the fire is made up; and in closed stoves it must burn steadily for long periods and also pick up well. And it must be convenient after we burn it—that is, there must not be much ash and what there is must not fly about. This analysis of what is meant by convenience is not as subjective as it may seem, for it finds support in the qualities of the premium fuels whose sales make the upward trend of Tables II and III.

First, a fuel is most easily handled and stored, and the number of times that the fire has to be refuelled is reduced, if the fuel is dense. No fuel now being manufactured for the open grate meets this requirement. But the position is different among fuels for the closed stove. There, the premium fuels (and only these) are dense, with bulk densities of 45 lb. per cu. ft. and over. It is these dense premium fuels which, Table III shows, have increased their sales for closed stoves.

My second criterion of convenience concerns the performance of the fuel: it must burn well and long and, what is important, it must pick up quickly when the fire is refuelled. In addition, if the fuel is meant for the open fire, then it must light easily in the first place. In all these respects, the premium fuels are exemplary, and Tables II and III show that there exists a growing public which appreciates these merits. Moreover, the premium fuels are very consistent in their performance in these respects, from one consignment to another—and in the case of some of them, such as Phurnacite, from one piece to another.

My third criterion is convenience after the fire has burned out, and this is measured by the amount of ash left behind and by its nature. Here again, the premium fuels for the open grate and for the closed stove have a high standard. The premium smokeless fuels contain 7 per cent of ash or less—some of them much less. This low ash content has, in addition, a marked effect on the performance of the fuels on the open grate, which almost always falls off sharply when the ash content rises beyond 7 per cent.

In summary, what I have tried to show so far is this. There exists a rising demand for solid smokeless fuels of premium quality. In absolute terms, the demand for these fuels is still marginal, and the public for them small; but it has been a growing public year by year since the Beaver Report was published. This public is discriminating, and the fuels that it has been buying have had to satisfy fairly strict criteria of convenience: convenience before use, in use, and after use. A policy to develop new smokeless fuels should therefore take account of these indications of public preference. If new fuels are to reach the widest public which can be foreseen some years from now, when the Clean Air Act will become general, then of course they should be reasonably priced. But they should also incorporate those factors of convenience which have begun to show their appeal to a growing public; briefly, they should be dense, reactive on the open fire, and clean.

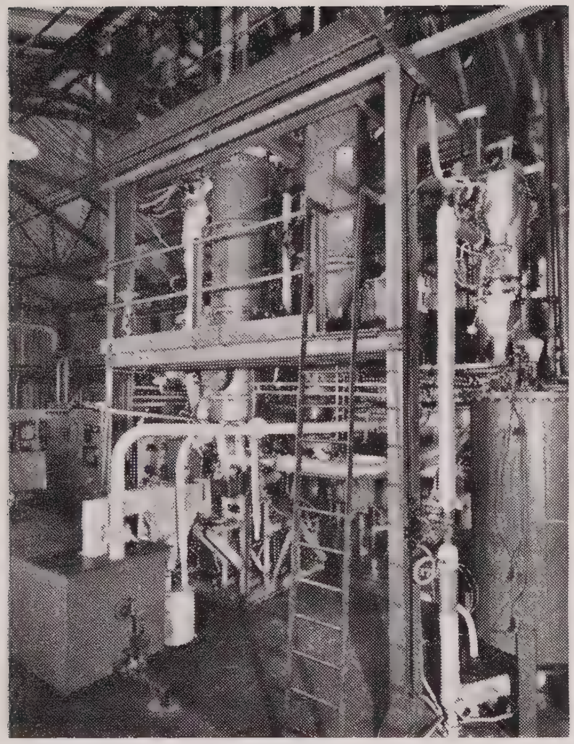
The main effect of the Clean Air Act is still some years away: we may estimate that it will be very substantial by 1965 but will not be felt fully until 1970 or later. The development of new smokeless fuels to meet this demand is therefore a long-term undertaking; in the long term, we have to prepare to replace up to 19 million tons of household coal. But there is also a short-term problem between now and 1965 which is pressing.

In the short term we must improvise: that is, we must use existing plants to make the best fuels that we can, even though these plants were not designed to make premium fuels. Both the National Coal Board and the Gas Council are already doing this. Two of the premium fuels which I have listed in Table II, Cleanglow and Phimax, are in effect improvisations by which premium fuels are made in existing gas retorts. Their production began only two years ago and has been successful.

In the same way, the National Coal Board has made Warmco, a new fuel which is not listed in Table II because its production began only in 1959. Warmco is a premium fuel which is produced in existing coke ovens by under-carbonizing a coking coal which has been specially cleaned. Thus Warmco is clean, with little ash, and it burns brightly and lastingly on any kind of open fire, and picks up well. It is one of the denser of the existing manufactured fuels for open grates, but even so is only just over half as dense as coal. The National Coal Board expects to produce 170,000 tons of Warmco in 1959 and this is, by any standard, a large output in the first year of a new fuel.

Nevertheless, processes of these kinds cannot offer a permanent solution for the production of smokeless fuels of high quality. The plants which these processes use were designed for other purposes, and making premium fuels in them is essentially an improvisation. As an improvisation, it is admirable and necessary, but to treat it as a long-term solution is to condemn ourselves to a static technology. For example, we cannot hope to make a dense smokeless fuel for the open fire in existing plants, and this in itself would bar progress towards better fuels. But above all, there are economic reasons why we cannot improvise indefinitely the making of premium fuels in existing plants. These plants have a low throughput, which means that they are now very costly to build. For example, new coke ovens cost about £9 per ton/year of coal input, which makes a cost of about £12 per ton/year of solid fuel output, or £18 per ton/year of solid fuel of the sizes preferred for the open grate. Capital charges on this scale would impose a heavy burden on the economics of making Warmco, for example, if new ovens had to be built specifically for its manufacture.

If we are to give the public premium fuels for the open fire in quantity and



Experimental plant for making char briquettes

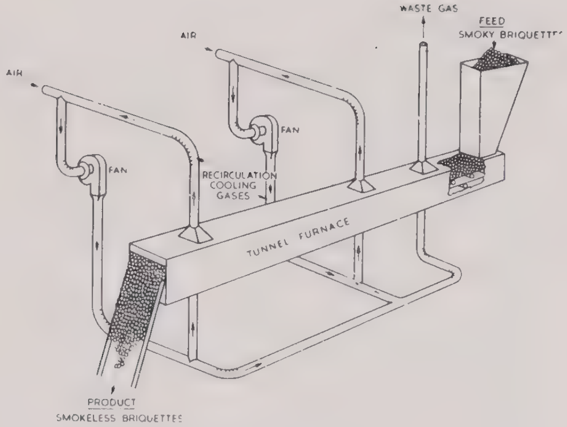
at reasonable prices, then we must approach the problem of coal processing in a radically new way. A new technology is needed to work from those coals which are plentiful today to those fuels which the modern public wants, and to do so economically. This new technology must satisfy three conditions. It must be low in capital cost and high in throughput: to this end, it must use the techniques of modern chemical engineering. It must use those coals which are plentiful today, that is, small coal with a high content of volatile matter—and yet it must get a high yield of solid fuel from this gassy coal. And finally, it must make what the public wants, a convenient fuel, which is dense, which burns well and picks up well, and which does not leave a bulky fly ash.

The National Coal Board has carried out detailed research to meet these three basic conditions for some years. I will describe fully one of the new processes which our research has produced, and which the National Coal Board is now developing, in order to show in detail how these conditions are met.

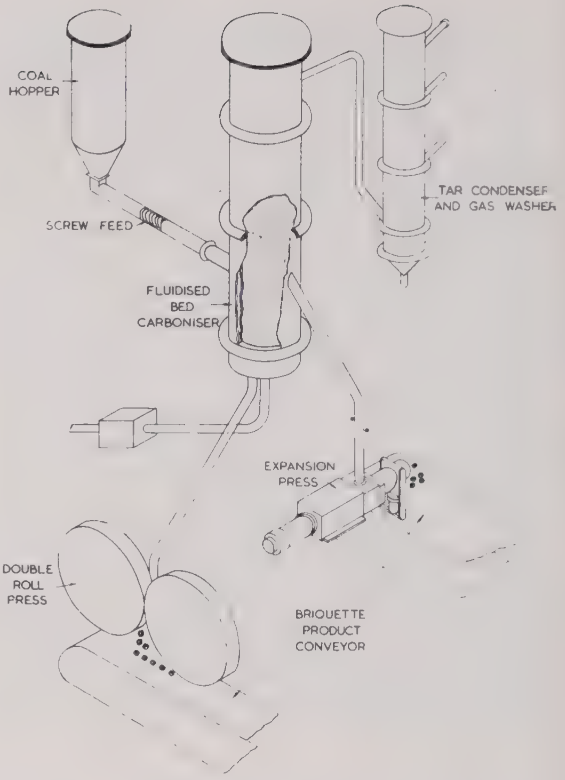
The process which I shall describe takes a powdered coal and blows hot air through it at a temperature between 375°C. and 450°C. When air is bubbled through a powder in this way, the mixture moves and flows like a liquid, and can therefore be handled easily; this is the physical advantage of this method of treating solids in what is picturesquely called (because of the way in which the mixture flows) a fluid bed. The chemical advantage of the method is that it allows hot air to reach every particle of coal at the same time, and therefore the time of treatment is short and the throughput of the plant is high. In the fluid bed, we expose the coal to the hot air for less than an hour; a coke oven may treat its charge for as long as 20 hours.

I have already said that we work at temperatures between 375°C. and 450°C. These are low temperatures, and they drive off only part of the gas in the coal; whereas the coke oven, working at high temperatures for a long time, drives off almost all the gas. Starting with a coal which has a content of volatile matter over 40 per cent, we make in the fluid bed a coal powder which is only partially coked—what we call a semi-coke or a char—and which still contains about 25 per cent of volatile matter. This high residue of gassy matter gives our process two advantages. In the first place, we have a high yield of hot char —85 per cent of the dry coal that went into the fluid bed. And in the second place, when the char is compacted, we have a lively fuel which burns with an attractive flame, and which is particularly quick to pick up when new fuel is put on after the fire has died down.

On two grounds, then, it is an advantage to leave 25 per cent of volatile matter in the char that comes out of the fluid bed. But the obvious question is, Will such a char be smokeless? A coal which contains 25 per cent of volatile matter is not smokeless. The performance of semi-cokes or chars with a residual of volatile matter had already been studied by



Lay-out of experimental plant for the mild heat treatment of briquettes



Lay-out of experimental plant for making char briquettes

Piersol,[2] who had shown that they could be smokeless. Our research work carried on this study in the special setting of the fluid bed, and showed that under these conditions char can be made smokeless (with a content of 25 per cent and more of volatile matter) consistently from a wide range of coals. Thus the technical process rests on a scientific foundation —on the elucidation of the steps, quantitatively, by which gas is driven off from a smoky coal. The scientific finding is that, when we begin with a coal with a content of volatile matter over 40 per cent, the first 15 per cent or so which is driven off is the smoky constituent.[3] The 25 per cent or so of gas which is left behind at this stage is not smoky, and therefore a char made in this way is smokeless yet burns with a bright flame.

The char that comes out of the fluid bed is a powder which must be compacted into lumps if it is to be used on the open grate. To do this, we use one or other of two new technical processes which we have devised. Either we compact the char with a compound binder consisting of a mixture of raw coal and pitch: at 400 C. or so, this mixture also retains no smoky parts. Or we compact the char directly in a special press without a binder, using its own plasticity to give it coherence: this press is an application of the Shape process of binderless briquetting to which our research has given much attention. In either case, we turn all the char into dense briquettes, which resemble charcoal in appearance and in the flame they give. Thus, by making char first and then briquetting it, we do not lose any breeze or waste, as most other processes which make premium fuels do. Any fines and broken briquettes can be crushed and returned to the process for briquetting again.

There is another process to make a premium fuel which the National Coal Board is developing, to which I will refer more briefly. In this, coal is briquetted first, and it is then exposed to moderate heat in an oxidizing atmosphere for some hours. The temperature and the time of exposure depend on the coal, and an exposure of 1 to 2 hours at 200°C. to 300°C. suffices for most coals. The chemical effect of the treatment is complex, on the coal and on the binder; in part it is a slight desmoking of the kind that I have already described, and in part it is an oxidation and a polymerization. It results in making smokeless briquettes in which the content of volatile matter may be 35 per cent, and once again it gives a yield of whole briquettes without waste.

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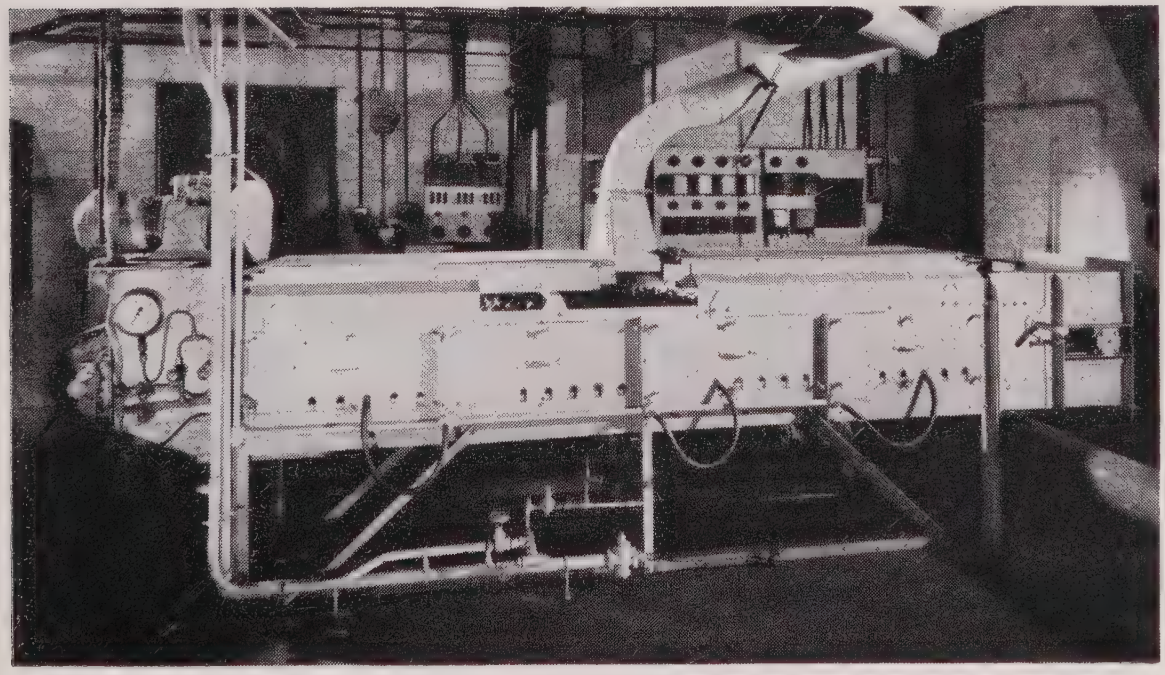
[2] R. J. Piersol, Rep. Invest. Ill. Geol. Surv. No. 41, 1936.

[3] W. N. Adams, A. F. Gaines, D. H. Gregory, G. J. Pitt, Smoke Emission of Low Temperature Chars, Nature, Vol. 183, 1959. Also D. H. Gregory and W. N. Adams, Smokeless Fuels from High Volatile Coals—I. and A. F. Gaines and G. J. Pitt, Smokeless Fuels from High Volatile Coals—II, Int. J. Air Poll., Vol. 1, 1959.

I have stressed that the mechanics of briquetting play an important part in these processes, and we have spent much research on them. It would take me too far to describe this important work which makes it possible to compact many coals and chars without a binder. Here I want to say only that our research work on the Shape process of binderless briquetting, and on other new briquetting processes, has been basic in enabling us to make premium fuels from coal which is cheap and plentiful—that is, from small coal. Briquetting has an essential place in the development of the complete processes which I have described.

Experimental char briquettes burning on the open fire

I have described two new premium fuels which the National Coal Board is developing: first, briquettes made from a char which has been made in a fluid bed, and second, briquettes made from coal which are subsequently treated by mild heat. Both these fuels, the char briquettes and the heat-treated briquettes, have been made only in experimental quantities of some tons, and the properties of the fuels in commercial production can only be established with certainty when pilot plants have been built to make them. Nevertheless, I will give, with some caution, figures for the performance of these experimental briquettes in Table IV. In this Table, the fuels have been tested according to the procedure laid down in the British



Experimental plant for the mild heat treatment of briquettes

Table IV

Performance of Warmco and Two Kinds of Experimental Smokeless Briquettes

(Tested by the procedure of British Standard 3142:1959)

		Warmco	*Experimental Char Briquettes*	*Experimental Heat Treated Briquettes*	*British Standard requirement for*	
					Type L coke	*Type M coke*
Bulk Density	lb./cu. ft.	24	38	41	under 23	over 23
Time to reach 200 B.t.u./sq. ft. h. after ignition	min.	33	23	28	37	45
Time to reach 350 B.t.u./sq. ft. h. after ignition	min.	57	35	42	—	—
Time to reach 350 B.t.u./sq. ft. h. again after first refuelling..	min.	24	15	29	—	—
Time to reach 350 B.t.u./sq. ft. h. again after second refuelling	min.	27	15	32	—	—
Peak radiation after ignition	B.t.u./sq. ft. h.	590	569	575	400	400
Peak radiation after first refuelling	B.t.u./sq. ft. h.	750	764	611	450	400
Peak radiation after second refuelling	B.t.u./sq. ft. h.	749	783	616	325	300
Average rate of radiation..	B.t.u./h.	9,690	10,030	8,640	—	—

The tests recorded in this Table have been carried out in the same laboratory under similar conditions, and the results are comparable among themselves. The test procedure used is that laid down in British Standard 3142:1959—Manufactured Solid Smokeless Fuels for Household Use. Part I: Cokes for Domestic Open Fires. This is the only British Standard specification for the performance of smokeless fuels which exists at present

Standards specification for fuels to be burned in modern improved open grates. I have also included in Table IV figures for the performance of the other new premium fuel which the National Coal Board is already producing, Warmco. It will be seen that our aim is to make fuels whose performance on the open fire will be outstanding. This should kill the lingering belief that the open grate is moribund, because it cannot give a cheerful fire unless it smokes; on the contrary, the open fire can burn brightly and yet give out no smoke. The char briquettes and the heat-treated briquettes also satisfy the other two criteria of convenience that I laid down: they are clean, and they are much denser than any other premium fuel. Experimentally, we make char briquettes to a bulk density of at least 35 lb. per cu. ft., and heat-treated briquettes to a bulk density of over 40 lb. per cu. ft.

These considerations will make it clear that the research programme of the National Coal Board over the last years has been well conceived to meet the demands of a more discriminating public, and the changing supplies of coal, both of which we anticipated. The Board has now formulated a full development programme to put its research findings into effect. Two substantial pilot plants for two different processes are now contracted for, and are expected to produce the first commercial samples of our new fuels to test the public response in the winter of 1960 to 1961. One of these plants is being constructed at Birch Coppice in the West Midlands Division to make char in a fluid bed and briquette it, on a pilot scale of about 5 tons an hour. The other is being designed to heat-treat briquettes made from coal on the same scale, probably at Graigola in the South Western Division.

I will remind you that the National Coal Board already produce a number of premium smokeless fuels, among them natural Anthracite and Welsh Dry Steam coals, Phurnacite and, for the open grate, its new product Warmco. The Board propose to continue to take a share of the market for such smokeless fuels as are required to make the Clean Air Act effective. It proposes to be guided by public demand, and to include fuels of the highest quality made by its new processes. It is the Board's policy to prove these new processes technically and commercially before 1965. The Board believe that this will require an annual rate of production of at least one million tons a year of the new fuels before 1965. It is at present impossible to predict total production beyond 1965, because the market acceptability of these new fuels at the price at which they can be sold economically has still to be proved. This is one of the prime objectives of the pilot plants with whose development I have been charged by the Board. It is the Board's intention to put itself in a position before 1965 to be able to expand production from these pilot plants to full commercial scale at the quickest possible rate justified by market requirements.

In carrying out this policy, the National Coal Board is not backing a single new fuel or a single new process. On the one hand, the new processes have still to be tried in competition with one another and with existing processes. On the other hand, the Board believe that in fact there is a variety of new fuels needed to satisfy the requirements of clean air, and to use those coals of which there is a good supply in different parts of the country. The Board's new fuels are not likely to prove equally acceptable for all purposes, and the scope of each will only be discovered by active development and manufacture on a limited scale, and this is now under way.

A last word about the cost of these developments, I estimate that commercial plants to use either of the two main new processes which I have described will cost less than £7 per ton of yearly output of fuel. The National Coal Board's intention of reaching an annual rate of production of at least one million tons a year by the new processes in 1965 commits it, therefore, to an expenditure approaching £7 million for completed plants.

In addition, if public demand is seen to be rising before 1965, we have to expect that an investment about as large again is likely to be committed in plants under construction. To this must be added the cost of pilot plants and other development work. Thus, the National Coal Board will invest in its new processes for premium solid smokeless fuels a sum which is expected to reach £10 million by 1965, and which may approach £20 million.

The public demand will not be all for premium fuels, and the present premium fuel demand is only a fraction of the total fuel demand. In the nature of things, premium fuels are dearer than others and, whatever their convenience, there is a resistance to paying the enhanced price, and the market for cheaper smokeless fuels will continue for a long time. However, some of this price resistance is short-sighted, and has failed to calculate the realities of the household budget. The additional convenience and the higher thermal efficiency achieved with premium smokeless fuels are cheap. I have already remarked that heating is an exceptionally small item in the national average household budget: in fact, heating and lighting together account for only 5½ per cent (the smallest single item) in the index of the cost of living. The cost of house coal at London price is approximately 8d. per therm. and the cost of premium fuels for the open fire at London prices is approximately 10d. per therm. Therefore if all households in the country outside the black areas as well as inside them, were to change from coal to premium smokeless fuels for the open fire, their fuel bills would increase by one quarter, and this would raise the index of the cost of living by less than one point only. The bill for premium fuels, once the public gets the taste for them, is not high.

Nationally, the cost of eliminating the smoke of the open fire is not high. Yet if we are to stimulate the demand for these fuels, and to take advantage of the movement which has begun to show itself in the last four years, we must surely keep the cost as low as possible. This is why I have laid stress on new fuels made by new processes in new plants. The production of smokeless fuels needs as modern and scientific an approach as that of oil and electricity. We need to apply all the methods of advancing technology: to use our most plentiful coals, to process them by continuous methods with a high throughput, and to get a high yield of solid fuel which meets the demands of a discriminating public for dense, free-burning and lively fuels which are smokeless in the air and clean in the grate. Only if we fulfil these precise conditions will we compete with electricity and oil with lasting success. I believe that the development work of the National Coal Board in the field of solid smokeless fuels conforms to these fundamental standards of technical and economic progress.

Poles Aim to Cut Silesian Air Pollution

A team of experts investigating the problem of smoke and dirt in the atmosphere of the Upper Silesian industrial region has promised to reduce the dirt by 50 per cent. in two years. The region, Poland's major industrial area, is said to be among the smokiest and filthiest in Europe.

Fuel Economy Through Automatic Operation

A conference under the above title was held by the Combustion Engineering Association at Scarborough on November 3rd and 4th last. The papers contained a great deal of interest to those concerned with the attainment of clean air through efficient combustion of fuel in industry. This point was emphasised by Mr. R. H. E. Thomas, O.B.E., Marketing Member of the National Coal Board, in his opening address to the conference, in which he said that automatic boiler control would help to clean the air.

COKE FOR LIGHTING UP STEAM LOCOMOTIVES

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THE first steam engines in this country in 1804 were used by the collieries and in 1825 a passenger steam train ran between Stockton and Darlington, but it was not until 1830 that the first regular passenger service, between Liverpool and Manchester, was inaugurated.

The original engines, which were coal fired, created a problem with the amount of smoke they discharged which also proved to be a great nuisance to the passengers. The promoters were anxious to alleviate the discomfort caused and thus it came about that coke was used to provide the necessary steam for motive power and coke was the only fuel used on railway engines between 1830 and 1850. It was at this time that fireboxes were re-designed to burn coal and consume their own smoke. To burn coal without emission of any smoke at all was quite impossible, of course, and with the increased use of locomotives on an expanding railway system pollution of the air became more widespread.

The railway authorities were much concerned at the increasing quantities of smoke emitted from their engines, which gave rise to many complaints being made by local authorities as well as residents in the neighbourhood of railway depots where the nuisance was greatest. In 1954 the Beaver Committee on Air Pollution reported:

> " Railway locomotives are responsible for over one-seventh of all the smoke discharged to the atmosphere. Most of this smoke is produced by shunting engines and stationary locomotives and it therefore tends to occur most frequently in those urban areas which are already liable to serious air pollution. We have heard many complaints from local authorities and the public about the harmful and objectionable effects of the excessive smoke and grit which occurs in the vicinity of railway stations, engine sheds and marshalling yards."

Light smoke only is emitted whilst trains are actually moving but quite large quantities of dark smoke are to be observed from engines during lighting-up periods. And so it became clear that some improvement could be made on the bad conditions prevailing at the depots if a smokeless fuel could be used in the lighting-up process. The British Transport Commission consulted the Coke Department of the Gas Council with a view to using gas coke and, as a result of the discussions which followed, full investigation was made into the use of gas coke for lighting locomotives as well as providing sufficient steam for working purposes in the initial stage.

Facilities for carrying out tests were provided by the British Coal Utilization Research Association in their laboratories at Leatherhead, Surrey, where a locomotive boiler fitted in engines of the " Royal Scot " type had been installed. The firebox has a grate area of approximately 30 sq. ft. and various types and sizes of gas coke were ignited by means of a Hypact burner and town gas. It had been anticipated that some difficulty would be experienced in the early stages of ignition owing to lack of chimney draught but in fact the coke ignited quite satisfactorily. Working steam pressures were reached without difficulty and only a blue haze was emitted from the stack. Steam pressures were obtained in times similar to those taken when burning coal—no modifications were made to the locomotive or additional apparatus (other than the gas ignition burner) used.

Gas cokes of No. 1 and No. 2 sizes from both horizontal and intermittent vertical retorts were used in the tests and in all cases successful ignition was obtained. Generally, the firebox was charged with 3–4 cwt. of fuel, part of which was spread to give a thin layer covering the whole of the gratebars and the remainder heaped into a cone at the front of the grate. The cone was ignited in about fifteen minutes with a Hypact burner using gas at a rate of approximately 1,000 cu. ft. per hr. Additional coke was then added and when the fire was established it was covered by further supplies as and when needed.

After considering the results of the tests made at Leatherhead, the British Transport Committee arranged for similar tests to be carried out under working conditions at their Camden Motive Power Depot. These trials confirmed the outcome of the original tests.

The British Transport Commission, however, considered it necessary to have an alternative method of firing so that lighting could be made at any position in the yard or where a supply of town gas was not available. Therefore, further experiments were carried out using:

(*a*) paraffin flame gun;
(*b*) firelighters (similar to those used for lighting coal).

The procedure previously related was followed with the flame gun, which had a capacity of 1·8 gallons per hour, and successful ignition was obtained after ten minutes.

The firelighters used by the British Transport Committee consist of bundles of wood and shavings impregnated with wax. Twelve of these firelighters were ignited and placed in the centre of the firebox on a thin layer of large continuous vertical retort coke covering the grate bars. When this was well alight coke was added in small quantities at intervals as needed. Ignition was satisfactory but a certain amount of unburned products of combustion were emitted as a vapour in the early stages from the funnel as well as the firing doors.

All the tests have shown that a steam pressure of 50 lb. per sq. in. can be obtained in four to six hours when burning gas coke No. 1 (large) of any type and using any of the three methods of ignition described. A minimum of attention was given to the fire when using the gas ignition burner and the paraffin flame gun.

These experiments have established that all types of locomotives can be lit with gas coke without any risk of producing smoke, with no more difficulty than is experienced with coal and without increasing ignition time. With this knowledge the British Transport Commission hope to be able to solve part of their problem of smoke emission in those districts where depots are situated in smoke control areas.

Rotherham Miners Coal Replacement in Smokeless Areas

According to representatives of Rotherham (Yorks.) Rural Council's clean air committee (reported in the local press), miners living in smoke-control areas in that district will in future have the choice of coke or money in lieu from the National Coal Board, instead of their concessionary coal supply. Final arrangements for the new scheme are to be made between local branches at collieries and the N.C.B.

East Midlands Division

The Division met at Grimsby on November 5th and heard an address on " The Alkali Act and the Work of the Alkali Inspector," by Mr. J. Beighton, B.SC. In the morning the members visited the works of Courtaulds Ltd.

SOME SMOKE AND GRIT EMISSION PROBLEMS ENCOUNTERED BY N.I.F.E.S.

by

G. R. STERN, B.A., G.M.I.Chem.E., A.M.Inst.F.

SMOKELESS operation of industrial plant is a result of co-ordination of design, firing technique, type of fuel and rate of heat utilization.

Up till recently the designers attention has not necessarily been centred on the necessity to provide structural features which would assist in smokeless operation, consequently, there are numbers of boilers and furnaces which present serious problems when efforts are made to run them in compliance with the Clean Air Act.

Firing technique is closely connected with the type of fuel and the load on the boiler.

The fuels capable of producing smoke are coal and oil and of these two the former is of much greater concern.

Low volatile coals can be burned smokelessly without much trouble, but these constitute only a small part of the total tonnage of industrial coals, the majority of coals require for their complete combustion carefully controlled conditions of temperature and air supply.

The fundamental requirements to be met are:

1. adequate supply of air for oxidation of all combustible products of the fuel.
2. correct distribution of air to obtain good mixing with these products.
3. sufficiently high temperature to ignite the combustible gases.

It is not always easy to secure these condition, particularly with old plant, and at times considerable difficulties are encountered in finding the causes of the trouble, but once the diagnosis is made, a solution can normally be found.

The large number of Heat and Power surveys carried out by the National Industrial Fuel Efficiency Service in industry provide an excellent opportunity to find out what the various causes of smoke and grit emission are, how these problems are tackled and with what measure of success.

In order to investigate this subject a large random sample of cases dealing with smoke and grit emission was subjected to an analysis of causes and effects.

Seventy surveys have been examined covering a variety of fuel using plant as shown in Table I.

The total number of heat generating appliances was 142, of which there were 123 boilers including 7 oil fired, and 19 furnaces including 2 oil fired ones.

It is of interest to note that of the 142 appliances covered by this sample, 65 were hand fired, the next largest group being that of sprinkler stokers of which there were 42.

It is proposed to deal with oil fired plants and with grit emission in the latter part of this article.

First then solid fuel.

Analysis of this large number of cases has shown that the causes of smoke emission are varied but can be divided into three main groups:

A. Operational
B. Structural
C. Unsuitable Fuel

The division is not strict and there is a certain amount of overlapping.

Table I METHOD OF FIRING

Type of Boiler	*Hand Fired*	*Under-feed*	*Sprinkler*	*Coking*	*Chain Grate*	*Oil*
Lancashire ..	32	—	26	2	1	3
Economic ..	7	2	14	2	—	—
Vertical ..	4	5	—	—	—	—
Water Tube ..	—	1	—	6	6	—
Locomotive ..	2	—	—	—	—	—
Scotch Marine	1	—	2	—	1	—
Sectional ..	2	—	—	—	—	4
Furnaces and Ovens ..	17	—	—	—	—	2

It is proposed to consider these groups in some detail.

Operational causes

Broadly speaking operational causes are usually due to the ignorance of the boiler house staff, lack of training or in some cases due to the absence of co-operation between the steam users and the steam producer.

Experience has shown that for successful operation the boiler operator must have a knowledge of the rudiments of combustion, must know the properties of his fuel and must be able to interpret correctly the readings of boiler plant instruments.

An operator who fires his boiler by hand must adopt a method of firing suitable for the type of coal used, and must control the supply of secondary as well as primary air so that optimum conditions for combustion are attained.

The requirements of the Clean Air Act do not leave room for the untrained stoker and again numerous surveys have shown that severe cases of smoke emission were usually caused by poor firing technique.

But it is not always the stoker who is at fault. His efforts to fire the boiler correctly are often rendered ineffective by fluctuating steam load. Sudden changes in steam demand require frequent adjustments of the firing rate which in turn cause variations in firebed thickness. This may give rise to smoke emission. The reason is either lack of co-ordination of action between the process side of the works and the boiler house, or, as is sometimes the case, the nature of the process is such that peaks are unavoidable, in which case the only solution is steam or hot water storage.

Out of the 142 appliances covered by the 70 surveys, 80 were emitting smoke because of poor boiler operation which could have been avoided by correct firing technique, proper damper control and adjustment of secondary air supply. In 12 other cases the trouble was due to unsteady steam load, characterized by extremes of " peaks " and " valleys " or to loads outside the rating of the boiler, that is either overloading or underloading. The total number of operational cases was 92.

The table below shows the distribution of " operational " cases in relation to types of boiler and stoker.

As can be seen hand-fired boilers constitute the largest group. Hand firing has an inherent weakness, namely the cyclic character of feeding, the necessity of keeping the firedoor open while stoking and letting in large quantities of cold air with deplorable consequences of chilling flames and upsetting draught. Even with the maximum good will and effort from the stoker, some inadequacies are unavoidable and, though it should be possible to control smoke emission within the permitted limits of the Act, the propensity for trouble is considerable.

Table II

	Hand Fired	*Mechanical Stokers*			*Chain Grate*
		Underfeed	*Sprinkler*	*Coking*	
Lancashire	22	—	19	2	1
Economic	5	2	14	—	—
Vertical	3	4	—	—	—
Water Tube ..	—	1	—	4	4
Locomotive ..	—	—	—	—	—
Scotch Marine ..	1	—	—	—	—
Sectional	2	—	—	—	—
Furnaces and Ovens	8	—	—	—	—

Plant with sprinkler stokers are equally great offenders and the main causes are uneven fire bed, incorrect rate of feeding and faulty air distribution.

A few examples will illustrate the kind of defects encountered in various plants and the recommendations put forward to remedy the situation.

A Leather Company. One Lancashire, hand fired; One Cochran, underfeed stoker. Fuel: washed singles. Cause: insufficient secondary air, uneven fire-bed, poor damper control. The boiler operator was instructed in the correct method of side-firing of the hand fired boiler and maintenance of an even bed thickness. Dampers were adjusted to give a balanced draught. This brought about a complete cure.

An Engineering Firm. One Lancashire, hand fired. Fuel: washed nuts. Cause: low firing rate with fire bed giving "cold" fire. The correct method of firing was demonstrated by N.I.F.E.S. staff and instruction was given to the boiler operator.

A Paper Mill. 8 Lancashire boilers, sprinkler stokers. Fuel: singles and peas. Cause: too high rate of feeding on to a fire-bed which was exceedingly hot and operating at a minimum quantity of air. Reduction of feeding rate and draught adjustment turned out to be only partly effective and it was concluded that further improvement can be obtained by ensuring that the coal is of uniform size.

A Chemical Firm. 14 two-pass Economic boilers, sprinkler stokers with moving grates. Fuel: washed singles. Cause: uneven distribution of coal over the grate and poor primary air supply. There was a tendency for the fuel to pile up at the front of the grate, requiring frequent opening of the firing doors for correction. These faults have been put right by attention to the operation of the stokers and by balancing draught.

These cases are comparatively simple and typical of a large number of industrial plants. It must not, however, be assumed that all "operational" cases are as easy to solve as those above. Here is an example of a more involved case.

A firm doing annealing of steel wire rod and drawn wire.

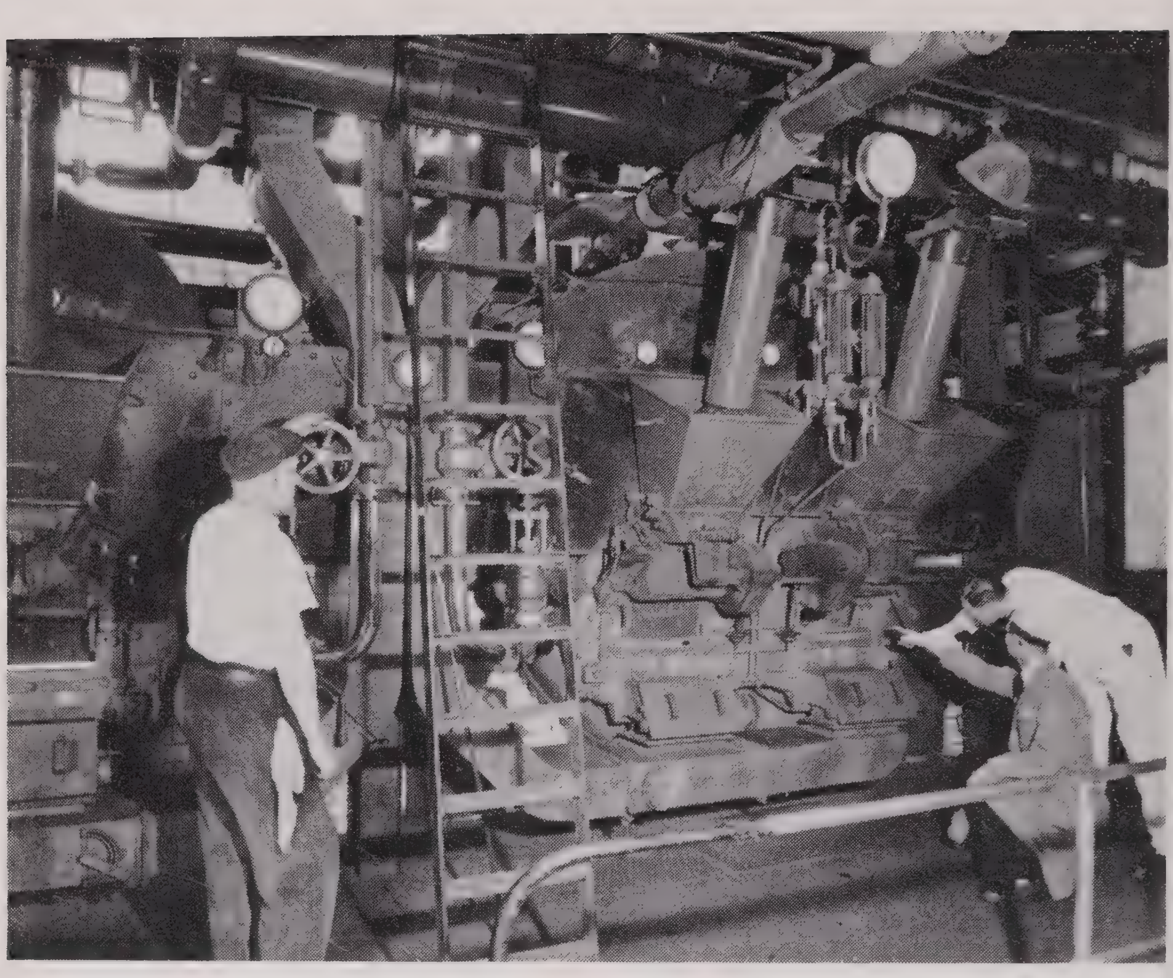
Plant—3 hand fired annealing ovens burning large bituminous coal. A detailed survey has shown that smoke emission was due to the following causes:

1. Insufficient draught, especially at the commencement of each annealing cycle.

2. Intermittent firing of heavy increments of large coal.

3. Insufficient turbulence because of bad design (this feature is mentioned here but it obviously belongs to the "structural" group.

4. The necessary practice of opening the oven door in accordance with requirements of isothermal annealing, allowing the internal oven lining to



A N.I.F.E.S. Engineer inspecting fire bed conditions at a firm seeking advice on a smoke problem

cool rapidly, thus promoting smoke formation when firing is resumed.

The recommendations put forward were as follows:

1. The initial firing stages should be with coal until a bright fire approximately 3 in. to 4 in. thick has been built.
2. An incandescent fire bed of coke is now built up by increments until it is approximately 12 in. thick.
3. A small amount of coal is then placed on the front of the coke bed and is allowed to burn through.
4. When the coal has burnt right through, it is then pushed gently to the rear of the grate and a fresh charge of coal is placed on the front.
5. The process should be repeated until the fire bed drops approximately to 6 in. when it should be replenished with coke by increments until a 12 in. bed has been restored. The coal firing cycle is then repeated.

The cure in this case lay in the use of a certain amount of smokeless fuel to give a foundation for an even and high temperature fire bed which would ignite the combustible gases discharged by subsequent shovelfulls of bituminous coal. The " coking " method of firing has been applied.

A somewhat similar case was at a works having a twin fire tube, hand fired Economic boiler run on high volatile nuts.

It was found that smoke emission was due to very light steaming conditions (25 per cent. of nominal rating) resulting in a low fire bed temperature and loss of ignition power.

It was decided to run the boiler on one fire tube only and to use a mixture of coke and coal. The method employed was similar to the one described above. Full instructions were given to the boiler operator. This resulted in complete cure.

In general, recommendations most frequently given to improve operation of industrial boilers and furnaces can be enumerated as follows:

1. Apply suitable firing method.
2. Improve damper control.
3. Maintain correct fire-bed thickness.
4. Control secondary air.
5. Reduce peak loads.
6. Adjust firing rate according to requirements.
7. Improve fuel distribution over fire bed.
8. Maintain a high furnace temperature.
9. Install mechanical stokers.
10. Instruct boiler operator.

Design faults

The second group, containing cases of smoke emission due to shortcomings in the design of the plant, is less numerous than the first and its total number is 25.

Table III gives the distribution of cases in respect to types of boiler and stoker.

The largest number of cases is, understandably, to be found in the hand-fired column, probably due to the advanced age of the plant.

Here are some of them:

A Furniture Factory. Two hand fired Locomotive boilers, natural draught, burning coal and broken coke. Investigation has shown that neither change of firing technique nor admission of additional secondary air were effective. The cure lay in the installation of a sprung refractory arch in the fire box, which reflected the heat radiating from the fire bed on to the combustible gases released from fresh coal, thus igniting them and supporting their combustion.

A Motor-Car Radiator Factory. One horizontal Thermax, one double pass Economic, Underfeed stokers, burning coal (nuts). Induced draught. Tests on this plant have shown that the boiler plant cannot be operated at full load without smoke emission, this being due to lack of fan capacity. The installation of a larger I.D. fan making it possible to increase the supply of secondary air and improved methods of fire cleaning effected improvement.

Iron and Brass Founders. A battery of 6 malleabilizing ovens in a continuous brick setting operated batchwise and intermittently for annealing miscellaneous small castings. Each oven is hand fired with coal and the draught is provided by a central brick chimney to which the ovens are connected by an overhead brickwork flue duct.

Some improvement was achieved by modifying operational procedure, but it was not possible to minimize smoke emission to the required limits. Complete cure could be brought about only if the design of the ovens were altered in such a way that the waste gases are redirected to allow their removal through the hearth of the oven and the firing is done on alternate grates each hour. Thus the smoke from

Table III

	Hand Fired	*Mechanical Stokers*			*Chain Grate*
		Underfeed	*Sprinkler*	*Coking*	
Lancashire	5	—	3	—	—
Economic	1	—	—	2	—
Vertical	—	1	—	—	—
Water Tube	—	—	—	2	—
Locomotive	2	—	—	—	—
Scotch Marine	—	—	2	—	1
Furnaces and Ovens	6	—	—	—	—

freshly fired coal would mix with the hot gases from the grate previously fired and be burnt off.

A Motor-Car Accessories Company. Two wet back horizontal Thermax boilers, coking stokers burning D.S. nuts. Numerous attempts to eliminate smoke emission using all available means to effect better operation, have produced no result.

It was then decided to disconnect the automatic control and to control the grate speed, fire thickness, etc., by hand, but this produced no improvement. Next step was to shut down No. 1 boiler completely in an attempt to determine whether smoke emission was from one boiler or both. Results indicated that both boilers were emitting smoke at approximately the same level.

All this led to the conclusion that the smoke trouble was not caused by method of operation but was due to faults in the design of the boiler furnaces. It was found that the bridge walls were too low and set too far away from the end of the grate.

An increase of the bridge wall height to approximately $\frac{2}{3}$ of the diameter of the furnace and a refractory arch built above the bridge solved the problem most satisfactorily.

A similar case was at another works having a Scotch Marine Boiler, chain grate stoker, burning coal.

Investigation has shown that smoke was caused by low temperature of combustion chamber, which was completely surrounded by water walls. Various expedients had been tried without success. The problem was solved by the installation of a refractory breast in each combustion chamber to form an ignition zone for the combustible gases.

Other cases in this group involve furnaces which require shortening of grate and so increasing the firing rate or which could not be run satisfactorily unless mechanical stokers were installed.

A N.I.F.E.S. Engineer demonstrating firing practice—side firing method being used

Unsuitable fuel

The third group consists of smoke emission cases caused by unsuitable fuel, the change of which was considered necessary to reduce the nuisance. Coals which are prone to smoking are those with a high volatile content and those with strongly caking properties.

Under suitable conditions it should be possible to burn both these types of coal within the limits of the Act.

The combustion of high volatile coal has been referred to above and the adequate supply of secondary air to a hot zone of the furnace is of the utmost importance.

Caking coals are considered " difficult," but can be burned fairly successfully on most types of mechanical stoker provided the following three points are borne in mind:

1. It is essential to burn these coals at a high rate.
2. Better results can be obtained if the coal is graded or at least the size differences are not great.
3. The caking properties of the coal can be reduced by surface moisture.

The distribution of these cases with respect to types of boiler and stoker is shown in Table IV.

Here again a few typical examples of surveys will illustrate the kind of difficulties encountered and the reasons why it was necessary to advise to change the type of fuel.

A Flour Mill. Three hand-fired Lancashire boilers, forced draught using strongly caking coal. Experiments involving different firing techniques and adjustments of draught had produced no improvement. Frequent use of fire irons was found necessary to break up the fire bed; this resulted in unduly heavy and prolonged smoke emission. It was therefore decided to try out other coals, of which one with lesser caking properties was capable of giving trouble-free combustion.

An almost identical case has been recorded at another works in the same area. The plant consisted of one hand fired Lancashire boiler using washed singles of strongly caking properties. All efforts to minimize smoke had been defeated and not until the type of coal was changed has satisfactory progress been made.

Oil Firing

Although liquid fuels are usually burned with the least degree of smoke trouble, there have been cases when N.I.F.E.S. engineers were called upon to deal with difficulties of this nature.

In our sample there were only four plants with a total of seven boilers and two muffle furnaces at which smoke emission occurred, and it was found due to one or a combination of the following:

1. Low preheat temperature
2. Overloading
3. Inadequate atomization.
4. Chilling of flue gases below dew point thus causing condensation and agglomeration of smuts.

All these cases have been put right.

Table IV

	Hand Fired	*Mechanical Stokers*			*Chain Grate*
		Underfeed	*Sprinkler*	*Coking*	
Lancashire	5	—	4	—	—
Economic	1	—	—	—	—
Vertical	1	—	—	—	—
Water Tube	—	—	—	—	2
Locomotive	—	—	—	—	—
Scotch Marine	—	—	—	—	—
Furnaces and Ovens	3	—	—	—	—

The Emission of Grit and Dust

Unlike the case of smoke emission there is, as yet, no legal standard by which permissible dust concentration can be measured and the requirement is that any practicable means there may be should be taken to minimize the emission of grit and dust from chimneys.

It is therefore not surprising that the number of " grit " cases constitutes a small percentage of the total number of surveys.

In fact there were only four among the 70 surveys under consideration and it is proposed to describe them in some detail.

An Engineering Firm. Boiler plant, one Lancashire boiler with sprinkler stoker, one Lancashire boiler, hand fired. Fuel—washed singles with high percentage of fines. A test was carried out by running the boilers at full load and collecting grit emitted from the chimney on greased test plates placed at various points in the vincinity of the chimney and in the direction of prevailing wind. The result was a heavy grit deposit.

Another test of the same duration with a light load to simulate summer conditions, produced a correspondingly lighter deposit.

From observations of the fuel in use it was suspected that the grit emission was entirely due to the high proportion of fines and a trial load of another coal, D.S. nuts, was obtained for a similar test.

With both heavy and light loads the amount of grit collected on the test trays was negligible and consequently a change of coal was recommended.

A Motor Car Company. Boiler plant: six La Mont High pressure hot water boilers, underfeed stokers. Dust collector through which flue gases from all boilers are drawn by an I.D. fan and discharged into a 50′ chimney. Fuel—D.S. nuts with a considerable proportion of fines.

Investigation has shown that it was not possible to operate the boilers with balanced draught over the fires. The draught induced via the dust collector had to be in excess of the natural draught because the dampers fitted to the individual by-passes of the stacks did not seal the apertures completely. The resulting big overfire draught carried large quantities of fines to the dust collector, thereby causing a rapid build up in the collector. Thus frequent tapping of the duct collector plates was necessary. This cyclic operation upset the draught equilibrium and frequent adjustments of individual damper had to be made.

The recommendations put forward were:

1. The stack dampers must be made to fit more closely.
2. Make sure that reasonable quality fuel is delivered to the plant and that the proportion of fines below $\frac{1}{8}$ in. does not exceed 10 per cent.
3. Mechanical means of rapping the dust collector should be provided so that the cleaning can be done without the necessity of opening up the collector, thus enabling more consistent draught conditions to be obtained.

A Rubber Company. Boiler plant: two wet back Scotch Marine boilers, sprinkler stokers, induced draught fan, 80 foot chimney. Fuel—singles with a certain amount of fines. Various attempts to alleviate the rather serious grit emission were made, such as reduction of draught, careful control of firing and combustion conditions, but no improvement was obtained. It has therefore been concluded that the elimination of the grit emission can be achieved only by an efficient grit arrestor. After careful consideration of the specific conditions of the plant an indication was given as to the most suitable type and size of arrestor.

Space Heating of a Large Building. Boiler plant: two 3-pass Economic boilers, sprinkler stokers, induced draught fan. Fuel—coal nuts.

Although grit emission was not very heavy, nevertheless it presented a public nuisance because of somewhat special conditions. These were the presence of a lighting well in the centre of the main block, the proximity of the chimney stack to the lighting well, the general shape of the building and the rather stringent requirements of the establishment.

The main causes of grit emission were the type of fuel, and the unsuitable type of stoker.

Two six-hour tests were run, one under hand-fired conditions and the other with mechanical stokers. Catchment plates were placed on the roof and grit samples were extracted from the casing of the induced draught fan. Subsequent weighings of collected samples have shown that the emission is greater with mechanical firing than with hand firing.

The size of grit was such that it could have been satisfactorily trapped by a simple arrestor.

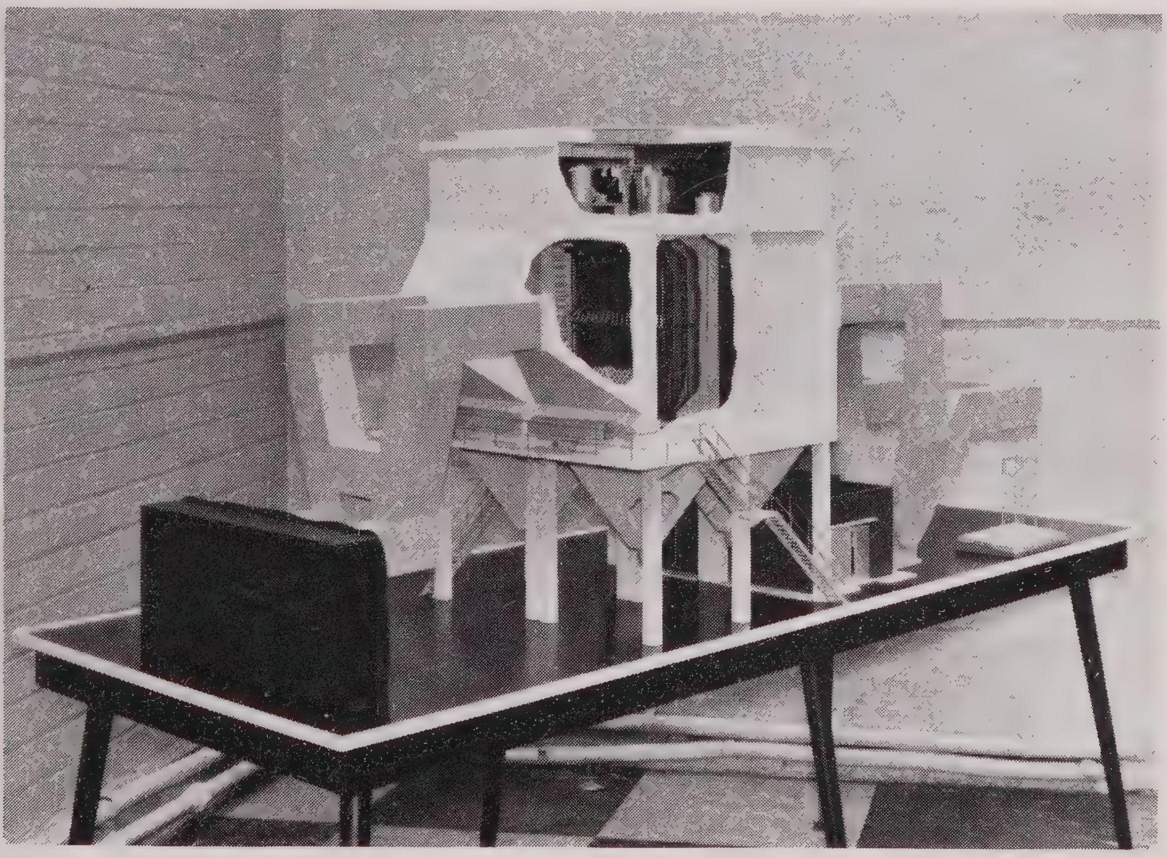
The operation of the sprinkler stokers was unsatisfactory and a considerable amount of manual work had to be done to spread the fuel on the grate. The firing rate was so moderate that mechanical firing did not seem justified in the circumstances and in this particular instance hand firing would require less effort and would produce better results.

In view of these findings it has been recommended to stop using the sprinkler stokers and fire the boilers by hand; to install a simple grit arrestor; to improve the damper control mechanism and to fit draught gauges which would indicate the effects of the damper adjustment.

As can be seen from this analysis, the reduction of smoke and grit emission from industrial plant is a problem to which there is no universal solution.

Each case has to be treated individually and whilst in the majority of cases, the remedy may be simple, there are instances which present considerable difficulties and can be corrected only by some structural alterations or by a total change of plant.

The Engineer on test work is at times compelled to resort to empirical methods and often, only by a process of elimination, is it possible to track down the real cause of trouble.



One of the exhibits at the Diamond Jubilee Exhibition—a model of a Holmes-Elex electrical precipitator, of the type installed after P.F. fired boilers, as at the new Elland Power Station

AIR POLLUTION ABSTRACTS

International Conference Special Record

Following is a complete set of abstracts of the Papers presented at the Society's recent International Conference in London

351. Air Pollution Legislation and Administration in Great Britain. Coates, P. D., Ministry of Housing and Local Government. The paper outlines the ways in which air pollution from industrial gases, industrial and domestic smoke, and grit and dust are dealt with. The requirements of the Alkali Act and the methods of the Alkali Inspectors, the Clean Air Act and the duties of the local authorities are also outlined. Research is being undertaken into aspects of air pollution which cannot be dealt with because of lack of technical knowledge.

352. A Planned Investigation of Air Pollution in Gothenburg, Sweden. Brosset, C. et al. An increased amount of air pollution has been noticed in Gothenburg as the result of the establishment of an oil refinery and a number of district heating plants. Gothenburg is also the biggest port in Scandinavia, and has a number of large industrial plants. Since 1945 measurements have been taken using English instruments situated at one central point in the town and it has been decided that these observations should be extended by placing several batteries of instruments over a wider area. A team of scientists and medical experts has been formed and it is proposed to take measurements of solid pollutants, thirty standard deposit gauges, five lead peroxide instruments and five daily smoke filters distributed throughout the town. A Pilot survey is also to be made on the effects of varying atmospheric pollution on the state of health of a small group of chronic bronchitics. This investigation is the first of its kind in Sweden and was planned to start in October 1959.

353. The Successful Anti-Smoke Programme of St. Louis, Missouri, U.S.A. Carter, J. H. The amount of air pollution in St. Louis has been reduced enormously in the last twenty years and this paper sets out the provisions of the legislation by which this was accomplished, the principles upon which these provisions were based and the means employed by the control office in their enforcement. The amount of pollution in St. Louis was caused largely by the availability of a large coalfield, the coals of which are of a volatile character. The attack on air pollution was based on the principle that all those who desired to fire by hand must use a smokeless fuel while others must use mechanical fuel burning equipment. The provisions of the ordinance or bye-law by which this principle was put into effect are listed. The city is divided into nine districts each with an inspector who has the duty of enforcing the legislation. There are provisions for chimney dust loading tests. All new plant has to be approved by the enforcement authority and all coal dealers in the city require a permit to operate. The division publishes its regulations in booklet form for the design of fuel plant and also a booklet on "Sources of Solid Fuels" which gives analyses of coal from several hundred mines in various parts of the United States. There is a staff of twenty engineers, inspectors and office workers.

354. Legislation and Administration in Small States (Eire). Dawson, F. E. The author discusses legislation and administrative requirements for clean air in small or less industrialized nations, stemming from personal consideration of the question in the Republic of Ireland. An outline is given of an appropriate form of Act, which it is suggested should give flexibility and ability to meet changing conditions by means of Regulations. The form and functions of an administrative Steering Committee are described.

355. The Present Degree of Air Pollution and the Relevant Laws and Regulations in Force in the Federal Republic of Germany. Federal Ministry of Labour, Germany. The problem of air pollution in the Federal Republic has increased with the growth of industry since the last war. The Industrial Code provides for prior approval of industrial plants. Police regulations control some forms of pollution as a measure of public safety. Motor vehicles are controlled under the provisions of a separate ordinance. Adjustments of the laws and regulations are under active consideration to meet changing conditions.

356. Air Pollution Problems in the Federal Republic of West Germany. Guthmann, K. Germany has recognized that legal regulation of Air Pollution would be inadequate and impossible unless based on proper scientific and technological data. In 1955 a Verein Deutscher Ingenieure committee for the prevention of Air Pollution was established. The committee is made up of experts from many German industrial associations and of scientists of many different disciplines. This committee supplies the legislators with technical data. Investigations are carried out by private and university research institutes, and so far 1·3 million Deutsch marks have been made available out of public funds. It is not possible to introduce a comprehensive special law at present, but the draft proposal for amendment of trade regulations and the supplement of the German Civil code has been placed before the Bundestag. The committee for the prevention of Air Pollution has established directives, applicable to new plants, which limit the permissible dust loading of the outside atmosphere, deal with the reduction of dust emissions and contain directives and explanatory notes regarding the reduction of dust-like emissions.

357. The Development of Public Opinion on Air Pollution in South Africa. Halliday, E. C. Interest in air pollution in South Africa began in 1948, but public opinion was not sufficiently strong to support expenditure. London " smog " of 1952 and an abnormal " smog " in Durban recreated interest. Council for Scientific and Industrial Research organized a national conference. Lectures and talks have been given by scientists working on air pollution. Public opinion is demanding controls on emissions from industry. When domestic smoke is dealt with a new type of education will be necessary.

358. Public Opinion and Education in Japan. Institute of Public Health, Japan. Their activities in the fields of information and research are listed. Other educational activities for abatement of pollution found in each community are given including such activities as refresher courses for boiler men, lecture meetings and film shows. Some communities are considering the institution of Smokeless Areas and are issuing Pollution forecasts. Public opinion and the press have both shown increasing interest in air pollution problems. The National Institute of Public Health undertakes the education of Health Education Officers. The establishment of a comprehensive organisation for the prevention of Air Pollution is now being planned. Japanese Academic societies are also showing considerable interest.

359. Legislation in Japan. Institute of Public Health, Japan. No general law has yet been enacted in Japan for prevention of Air Pollution, but Public Opinion increasingly demands such a law. In the meantime local governments have passed their own ordinances. These are divided into two categories, the first of which deals with the prevention of public nuisance in offices and workshops, and the second, which applies to Tokyo, deals with the public nuisance caused by smoke other than that produced in workshops. A table is given showing the administration and organization of these ordinances. Figures are also given for the budgeted costs for 1959.

360. Some Activities in Belgium in the Field of Atmospheric Pollution During the Last Five Years. Leclerq, E. More attention has been paid to air pollution in Belgium since the Meuse valley fogs of 1930. The Belgium Town Planning Administration has commissioned an air pollution study of the Liege region, as part of a general planning survey of the region. A number of experts have undertaken other studies and published results.

361. Atmospheric Pollution Problems in Norway. Lindberg, W. Atmospheric pollution in Norway has not been a serious problem in the past, but in the last few years fluorosis in cattle caused by air pollution and pollution of the grass with fluorides from aluminium industry has been of considerable public interest which has led to the appointment of a Committee on air pollution. The Committee is to investigate what can and should be done to prevent air pollution and eventually to recommend abatement laws and regulations. The 1958 report of the Committee contains suggestions for dealing with pollution problems. Although air pollution in Norway is not disturbing compared with other countries, analysis of the measurements taken in recent years shows that it is a considerable nuisance. It is suggested that even more use should be made of hydro-electric power for domestic heating and so reduce even further the amount of pollution.

362. **Public Opinion and Education for Clean Air in the United Kingdom. Marsh, A.** The general question of creating an educated public opinion on air pollution and its prevention is discussed with particular reference to the United Kingdom and the work of the National Society for Clean Air. The work falls into two main categories—that directed towards the groups which themselves lead or create mass public opinion or are concerned technically or administratively with the problem, and the mass publicity that is called for when the community in general is directly affected by clean air legislation, for which considerable resources are required.

363. **Investigations on Air Pollution In Basle, 1957-1959. Muller, T.** The town of Basle is the second in Switzerland. A growing chemical industry has given rise to complaints especially in respect of odours. Measurements have been taken of dust, SO_2 and H_2S, and it is concluded that, despite industrialization, the town still remains very clean.

364. **Clean Air in Czechoslovakia and Means for Improvement of Today's Conditions. Polacek, J.** The growing industrialization necessary to raise the standard of living is also causing an increase in air pollution. The types of emission, climatic conditions and effects of pollution are described. Extensive research is being undertaken and efficient methods of dealing with the pollution are being evolved, *e.g.* by converting industrial plants to natural gas.

365. **Parliamentary Initiative for the Prevention of Air Pollution in Germany. Schmidt, O.** The paper describes the steps which have led to the introduction of a Bill dealing with industrial air pollution. The Bill originated from the initiative of the Inter-Parliamentary Working Community, an organization of about 300 deputies of the Federation and the Laender. It has all-party support. Technical provisions have been specifically avoided in the drafting, as they soon become out-dated. It is hoped that the Bill will become law shortly after the Society's conference.

366. **Progress and the Future in Air Pollution in Allegheny County, U.S.A. Schreibeis, L.** A brief summary of the history of pollution abatement in Pittsburg is followed by a description of measurement methods used, with examples of figures showing the decline in pollution levels. This is followed by a description of sources of pollution. Particular attention is drawn to the high fuel consumption in the area and the problems of domestic waste disposal.

367. **Air Pollution Problems in Czechoslovakia. Spurny, K. and Lochmanova, E.** Air pollution has become a problem in Czechoslovakia in recent years. The main sources are coal burning, smelting and chemical industries. The two worst affected areas are Ostrava and Usti n.L. Measurements are being made and laws are being promulgated setting out maximum emission from new plants. Work is going ahead on all aspects of prevention, including potential dangers of atomic power stations and motor vehicles.

368. **Air Pollution Legislation and Administration in the United States. Tetzlaff, F. and Graber, R. C.** Since World War II increased interest in air pollution control has led to legislation at Federal State and local levels. The Federal Air Pollution Research and Technical Assistance Act was passed in 1955. The methods by which State, Regional and local control is carried out, are described. Independent air pollution control agencies are supportable only by large population groups. A minimum budget of 5 cents per capita is needed.

369. **The French Association for the Prevention of Air Pollution. Queret, Y.** The objectives and organization of the association, which was formed in 1958, are described, and some of its principal activities are outlined. These include the measurement of air pollution and schemes for setting up smokeless towns, the first of which Boulogne-Billancourt, an important suburb of Paris will be established this winter.

370. **The Growth on World Fuel Consumption and its Threat to Clean Air. Daniel, G. H.** Population growth and industrial expansion are increasing world energy requirements at over 5 per cent. per year. The growth in fuel consumption is accompanied by a slow but significant deterioration of the fuel mined, including with both coal and crude petroleum a rising sulphur content. The use of oil for road vehicles has doubled during the

past 12 years. There is also a continuing transfer of population from rural to urban life, leading to larger towns and cities. The outlook for clean air would be depressing but for mitigating factors described—industrial units tend to become larger, with improved combustion control and facilities for gas-washing, etc., and there is an increasing use of refined fuels which relatively, tend to become cheaper. The incentive to remove sulphur from fuel is increasing, linked with increasing sulphur needs. The world picture for clean air is one of light and shade. Policies are required to harness industrial economic motives and developments with the not less important objective of reducing pollution.

371. Fly-Ash Collection in Plant Using Second Rate Fuel. (Czechoslovakia). Bohm, J. In Czechoslovakia, the use of the best coal as raw material for the chemical industry necessitates the use of second-rate coal in power stations. This means that design requirements of dust collectors and electrostatic precipitators in particular are severe. Theoretical calculations and practical measurements were made of the efficiency of electrostatic precipitators. Some results of these investigations are given. For collection of fly-ash from second-rate fuel, the stress must be laid upon the high value of the space-charge density of ions in the gas. A tube type precipitator shows advantages.

372. The Development of New Smokeless Fuels (Great Britain). Bronowski, J. There are signs of an increasing public demand for " premium," i.e. high grade, solid smokeless fuels. The reasons for this increase in demand is convenience. This total convenience is made up of easy handling and storing, brightness in burning and rapid pick-up after refuelling, and a low ash residue which does not blow about. In the short-term the increase in demand is being met by adapting traditional plant and methods. New processes are being brought into production to meet the longer-term demand resulting from the Clean Air Act; these processes are more economic and produce a better fuel. The nature of these processes is outlined.

373. A Commended Solution for the Problem of Air Pollution (Belgium). Delbruyere, R. The author suggests various methods which could be used to deal with the main sources of pollution. Motor vehicle pollution could be dealt with by de-sulphurization of oil, the fitting of various cleaning devices, sealing engine components, and revocation of offenders' licences. Technical means exist for dealing with industrial pollution, and industrialists should not consider them a charge on the industry, as, often, they enable some economy to be made. District heating is a possible solution. There is a need for more green spaces in built-up areas. There is also a need for an inter-nation convention.

374. The Coking Industry: its Problems and its Contribution to Clean Air. Cooper, R. L. The coking industry is one of the main coal consuming industries in Britain. The coking process itself cannot be operated smokelessly within the normal requirements of the Clean Air Act, by methods that are reasonably practicable economically and technically. It has therefore been placed under the control of the Alkali Inspectorate. The chief source of offence is the coke oven battery. Smoke and dust are mainly given off during charging of the battery with coal, during discharge of the coke, and during the quenching of the coke with water. Methods are described by which the nuisance from each of these processes may be alleviated.

375. Education as an Aid to Industrial Smoke Elimination (Great Britain). Duguid, S. N. The paper describes the work done and organization in being in Great Britain for the training and certification of boiler operators as a means for smoke prevention and fuel efficiency. Results for recent years are given and methods of training are outlined. The training of the Smoke Inspectors of the Local Authorities are also described.

376. Gas in Industry (Great Britain). The Gas Council. The paper reviews the many uses of gas for industrial purposes in Great Britain, with reference to increased technical efficiency and convenience as well as to the prevention of smoke and reduction of sulphur oxide emission. Examples are given.

377. Removal of Dust from Brown Fumes in Oxygen-Blowing Steelworks (West Germany). Guthmann, K. The problem of removing dust from the brown fumes arising in the LD-(Linz-Donawitz) oxygen steel making process may be regarded as solved. In some cases a reasonable use of waste heat and precipitated dust may even make gas cleaning an economic proposition. Electrostatic precipitators were found to give the best results and the utilization of waste heat is considered a prerequisite for any economic method of dust removal. Examples are given of several arrangements of plant and the operational results therefrom.

378. Technical Removal of Dust as Dealt with by the European Coal and Steel Community (West Germany). Guthmann, K. In 1958 the High Authority of the Coal & Steel Community, in agreement with the Special Ministers' council, approved considerable grants in aid to assist in carrying out the four-year study in the field of dust removal in collieries, iron ore mines and metallurgical industries. This paper is an outline of the programme for this four-year study, under the following headings. Technical removal of dust in mines with particular attention to combating silicosis, and technical removal of dust in the iron and steel industry, which latter is divided into applied and basic research.

379. The Problems of Air Pollution by Diesel Road Vehicles (Great Britain). Jacquest, J. W. A very great deal of the increasing nuisance from diesel smoke is the result of poor or non-existent maintenance. Fuel injection equipment is complicated and requires regular maintenance; compression should also be checked frequently. Operators should realize that smoking engines waste fuel. Improved techniques in fuel injection and maintenance would reduce emissions to an acceptable level.

380. Environmental Arsenic Contamination and Control in Smelting Operations (Canada). Kay, K. Arsenic poisoning has in the past only occurred in areas remote from population centres and has therefore not affected human beings. Human poisoning has recently occurred in a populated area of Canada adjacent to two smelters engaged in the extraction of gold. After poisoning of cattle and humans, a continuous survey was started. A feature of the survey was the urinalysis carried out on local school children. The methods adopted to collect and store the effluent are described. The study shows that even in remote areas population concentrations develop when processes are successful. Operations must be planned with protective measures and uncontrolled stack discharge is not desirable.

381. Cheaper Cleaning Equipment for Air Pollution Control (West Germany). Kettner, H. The point is made that unnecessarily expensive solutions to air pollution problems are often put forward. An example is given in which a naphthalene works solved its pollution problem by a wet washing system, after a prohibitively expensive catalytic burning system had been suggested.

382. The Problem of Suppressing Dust and Gaseous Moisture at Emission Points in Relation to Air Pollution. Lasserre, P. The paper deals with the problem of dust and fumes from industrial processes other than combustion. It points out the desirability of picking up the pollution at source by means of hoods, etc., and cleaning the air drawn in before ejecting it to the atmosphere. Design considerations relating to suction hoods and ducts are discussed.

383. Elimination of Acidic Smuts. Lees, B. As the result of scientific research it has been shown that acidic smuts, which fall in close proximity to boiler stacks, may be formed by acid deposition on cool surfaces, such as ducts and metal stacks, through which the flue gases pass after the I.D. fan. Examples are quoted showing how this problem has been solved by:

(*a*) Operating the plant in such a manner that the SO_3 formation is reduced to a minimum.

(*b*) Designing the plant to eliminate the cold areas on which acid may condense.

The importance of making measurements to control experiments to overcome this problem are stressed, and simple but effective methods are indicated.

384. Fundamentals of Smoke Emission from Low Temperature Furnaces (Great Britain). Underwood, G., et al. The mechanism of smoke generation is explained. It has been found that neither a reducing atmosphere or smoke is needed to avoid scaling and decarburization of steel. There need be no smoke pollution from low-temperature furnaces, and if volatile, can be prevented from passing through regions of high temperature, then carbon formation is not likely to be severe, and the smoke can be burned at temperatures around 750°C. to 800°C. Work is also described which enables the number of secondary air jets, and their size, to be calculated for any particular furnace using secondary air.

385. Coal and Modern Equipment in Relation to Economy and Clean Air (Great Britain). Weinberg, S. and Randall, W. Coal is our main indigenous fuel and is the most economical when used in the correct appliance. Coal is at least as efficient as oil when used in modern properly maintained appliances. When so used, coal does not create a greater smoke problem than oil. Energetic action is being taken to control the fines content of coal and to maintain more consistent quality. A list of typical well-run plants is appended.

386. International Problems Relating to the Control, Inspection and Assessment of Air Pollution (West Germany). Berge, H. A distinction is drawn between methods of control applied to emissions and immissions. Control should be exercised over the level of pollution by taking as a guide the degree by which the environment is affected, e.g. the level of damage to plants and buildings. Control of immissions in this way takes into account such factors as industrial concentration. As far as is known only the U.S.S.R. has a law which deals with immissions.

387. Atmospheric Pollution in the Paris Area (France). Dr. Besson and Pelletier, J. The authors describe the measurements taken of various kinds of air pollution in the Paris area, and the results obtained. Comparisons between Paris and London or Glasgow are made. The laws in operation in France are outlined. While industrial establishments can be effectively controlled by the force of Inspectors set up under these laws, domestic pollution can only be dealt with by technical or economic changes. In the long-term, pollution should be dealt with by zoning and the creation of green belts. In the meantime a wider use of gas, sulphur-free petroleum products and district heating would provide a partial solution.

388. The Measurement of Sulphur Dioxide in the Atmosphere near Power Stations (Great Britain). Cummings, W. G. and Redfearn, M. W. By means of instruments developed at the Central Electricity Research Laboratories it is now possible to make a realistic assessment of the contribution of a power station to the total sulphur dioxide pollution in a particular area and to estimate the efficiency of the dispersion of plumes from stacks under varying meteorological conditions. The methods employed to make best use of these instruments are described, together with some typical results.

389. Researches on the Atmospheric Pollution of the City of Milan (Italy). Giovanardi, A., et al. A programme of air pollution measurement has been carried out in Milan over the last three years, measuring deposited matter, suspended matter, and sulphur dioxide (using the lead peroxide method). Twelve permanent stations have been used, plus extemporaneous measurements at other sites in the streets. It is concluded that badly run domestic heating systems are a greater cause of pollution during the winter than either vehicles or industry.

390. Monitoring the Flue Dust Surface Area (Great Britain). Grindell, D. H. The air pollution characteristics of flue dust are governed mainly by the size range of the particles, rather than with factors such as opacity and gross weight. An instrument, working on the principle of the electrostatic precipitator, has been developed, which records the surface area of dust sampled. It is sensitive to small as well as large particles.

391. Research on Air Pollution in South Africa. Halliday, E.C. Air pollution in South Africa has grown rapidly since 1930. Preliminary research has been carried out using British pattern instruments. Results show that pollution levels in large towns in the Union are comparable with pollution in English towns. As a result of increased interest, wider research projects should be possible.

392. Contributions to the ‘ Smog ’ Problem. Hettche, H. O. Smog is a synergistic effect of dust or soot and H_2SO_4. As it is at present not possible to remove the large quantities of sulphur oxides, attention should be given in combustion processes to the emission of a minimum of soot and dust into the atmosphere. As the appearance of one of the synergists is reduced, one may expect a reduction in smog-poison.

393. Research and Investigation in Japan. Institute of Public Health, Japan. Recent research and investigations relating to air pollution is carried out by local governments or local research commissions in the prefectures and cities. The various types of research undertaken are outlined. Since 1950 the number of reports on air pollution made public has gradually increased. A number of diagrams are given showing the weight of deposited matter in major industrial districts and cities. Differences in pollution between the different parts of cities show the principal source of pollution was industry. A list is given of the liaison organizations for expediting research and investigation.

394. The Durban Cleaner Air Campaign (South Africa). Johnson, K. R. Durban is not only a major port and South Africa's main holiday resort, but is also a thriving industrial city. Coal is the principle fuel and its use by unskilled stokers gives rise to considerable smoke. This combined with frequent inversion conditions, produces smog. Smokeless zones are being created and a close check kept on all plans for new buildings to avoid potential nuisances. Smoke Control by-laws have been created to prohibit industrial smoke, and successful arrangements made for the training of stokers. All new plant must secure prior approval. A merit system for firms, based on standard smoke observations, has been instituted. Public Service vehicles may have their licences withdrawn if they emit excessive smoke. Railways, ships and special processes also come under the control of the municipality and are being dealt with.

395. The Need for Standardized Methods in Air Pollution Surveys (West Germany). Kirste, H. The author points out that the lack of standardization in methods and apparatus makes it difficult if not impossible to make international comparisons of air pollution measurement. A committee of experts is suggested, who should as expeditiously as possible, work out simple but exact procedures and apparatus.

396. Dust Measurements to Determine the Sources of Emissions Damaging Crops (West Germany). Kirste, H. A survey of dust fall in a market gardening area was made to determine which factory was the source of damage to crops. The methods and results are described. The experience gained suggests that a large number of measuring points are needed, that the dust receivers should be simple, and raises the question of how long they should be exposed. It is also suggested that further analysis of the results and more truly comparable methods of measurement are needed.

397. The Calculations of Sulphur Dioxide and Smoke Concentrations from Domestic Sources in Cities. Lucas, D. H. The present report is a simpler version of a paper published by the same author which attempted to give a quantitative expression of the amount of pollution which occurred in cities due to domestic fires. The method used in the original paper to find the concentration produced in the city under given conditions was to use Sutton's formula to estimate the concentration produced by individual houses at different distances. The concentration at a particular place in the city was obtained by calculating the concentration produced by the nearby houses and adding progressively the concentrations produced by houses further and further away. It is concluded that a major part of the sulphur dioxide and smoke pollution in cities is due to the emission from domestic fires.

398. The Investigation of Air Pollution in Padua during 1955-1958. Paccagnella, B. The paper reviews the investigations carried out at Padua, using instruments and techniques based on British practice. The observations show that pollution is to some extent similar to that in many towns in Britain, but that there is a much wider ratio between winter and summer figures.

399. Air Pollution in the City of Genoa (Italy). Petrilli, F. Air pollution in the city of Genoa has been studied since November 1954 by the Institute of Hygiene of Genoa University of which the author is Director. The apparatus and equipment used are as advised by the British D.S.I.R. The paper describes the geographical and meteorological characteristics of the city and continues by describing the various air pollution sources. The researches have shown that sulphur dioxide in the residential districts is negligible and although higher in the industrial areas is not yet comparable to those in other foreign industrial towns. Pollution by iron dust is also low in the residential districts but peaks have been reached in the industrial areas comparable to foreign towns with ironworks and engineering works. Suspended dust remains within modest limits. Carbon monoxide does not reach high concentrations except in vehicular tunnels. The city is fortunate in that the meteorological and topographic conditions create a condition favourable for the dispersion of polluting substances. The paper is accompanied by a diagram and a number of tables.

400. Research into Air Pollution in the City of Essen (West Germany). Schwarz, K., et al. From November 1955 to February 1957, the Technisher Uberwachungs-Verein Essen e.V. carried out a series of measurements of dust deposition at 600 measuring points in the urban area of Essen, using the Diem sticky plate method. For comparison, each of the collectors used by the City of Essen since 1932 was supplemented by a sticky plate and a third type of gauge. A comparison of the results obtained with the various types of apparatus is given, together with some specimen maps of dust deposition in the city.

401. Determination of Particle Sizes in Industrial Aerosols of City Air (Czechoslovakia). Spurny, K., et al. In measuring the aerosols present in the air of Prague a combination of sedimentation and diffusion methods was found most suitable. Fine and middle aerosol fractions were retained for examination under the electron microscope by diffusion on fibrous crystals of copper oxide. Large fractions were retained for examination by optical microscope by sedimentation on vaseline coated slides. It is concluded that these methods are superior to thermal or electro-precipitator methods.

402. Some Conclusions on the Extent and Possibilities of Co-operative Research in Europe on Air Contaminants. Buxell, J. O. The recommendations of the two conferences on air pollution organized by the World Health Organization at Milan and Geneva, are listed. Some international co-operation is already taking place. There is need for further co-operation and exchange of information and as a first step the World Health Organization has prepared a list of organizations and projects now operative in Europe. Other possible steps are to enquire as to individual investigators and investigations; also to arrange visits from consultants to assess further potentialities for co-operation.

403. Morbidity and Mortality from Bronchitis in Sheffield in Four Periods of Severe Air Pollution. Clifton, M. et al. Bronchitis sickness certificates were used as a source of information on morbidity from bronchitis. They showed rapid and consistent increases during periods of increased air pollution. Bronchitis deaths are less satisfactory as an index of the effect of smog on health. The sickness certificates have shown their value as a research tool.

404. Research on Damage to Vegetation from Air Pollution at the University of California. Darley, E. F. The research is directed to the study of air pollution effects on agricultural crops, methods of reducing plant damage, and identification of phytotoxicants. The instrumentation used and the pollutants being studied are listed. Experiments are designed to determine the range of plants injured; symptoms of such injury and the time concentration levels required; effects on plant growth both lethal and sub-lethal; the nature of toxic action and identification of the phytotoxicants where these are not known.

405. An Electro-Precipitator for the Assessment of Domestic Smoke. Dickinson, R. and Kimber, D. E. The disadvantages of various traditional methods of measuring the smoke emission from domestic appliances are discussed. It is suggested that a more reliable measurement may be made by removing and directly weighing the whole of the smoke in the flue gases, and a suitably designed electro-precipitator is selected as the best instrument for this purpose.

The factors affecting the design of such an instrument are discussed. There follows a description of the finished instrument, which is a single stage, multi-tube precipitator of height 23 ins., overall diameter 13 ins. and weight approximately 15 lb. It is capable of collecting all the smoke emitted from a charge of coal on a domestic appliance under normal operation.

406. Some Measurements of the Smoke Emission from Domestic Appliances. Dickinson, R. and Kimber, D. E. The smoke emission from a number of domestic appliances has been investigated under various conditions, using a recently developed electro-precipitator which collects more than 97 per cent. of the smoke. A typical inset open appliance and bituminous coal have been chosen as standards for the purposes of comparison. A full account is given of the mode of operation of the precipitator and tests are described which establish that combustion rate, method of refuel and appliance design all affect the percentage smoke emission.

407. Emission of Oxides of Sulphur from Domestic Appliances. Gas Council. The paper deals with the effect on sulphur dioxide emission of using gas and coke in place of other fuels, particularly bituminous coal. The emission of sulphur from different fuels are compared. Coke fires, owing to greater efficiency, give off less sulphur dioxide than coal fires. Improvements in gas appliances and tariffs are making gas heating a more attractive proposition. Use of gas reduces sulphur dioxide emission a hundred times. Further reductions are expected from gas which is even more sulphur free.

408. Documentation of Air Pollution Requires International Co-operation. Harth, R. and Seidl, W. The department for documentation of the Verein Deutscher Ingenieure has established a system of documentation of air pollution. A system of classification has been worked out and is described. An international exchange of documentation is suggested and steps towards such an exchange are outlined.

409. Current Status of Air Pollution Research in the United States. Heiman, H. and Stern, A. C. Air pollution research in the United States is substantial and is financed mainly by government funds. It has reached its present level only in the last three years. A great deal of effort is being concentrated on vehicular pollution as exemplified by Los Angeles " smog." Work is also progressing on basic studies. A particular characteristic is degree of concern with analytical methodology. Intensive studies of health effects are being undertaken and are described.

410. Some Thoughts on International Co-operation in Air Pollution Research. Isaac, P. C. G. Advance in the control of air pollution depends on more research and on much swifter and wider dissemination of the results of research and practical measures, technical and legislative. These in turn call for: (1) An international research journal which can be met by the Journal of Air Pollution. (2) An adequate international abstracting journal. (3) Preparation by W.H.O. of details of research in progress. (4) Periodical international conferences, which seems to require an international association.

411. Steps Taken by Local Authorities in the Federal Republic of West Germany Towards Combating Air Pollution. Kelm, W. In Germany the number of complaints about air pollution is increasing, probably as a result of public awareness as well as an actual increase in pollution. German local authorities regard it as their duty to protect their population, by means specified in the paper. Investigations into the nature and sources of pollution are being undertaken and one investigation (in the Oberhausen district) is described. Arising from these investigations, several lines of policy for local authorities are suggested. The paper concludes by outlining some of the provisions of a new Federal Bill.

412. Problems of Smoke Emission of Coal-Fired Single Stoves. Lenhart, K. and Thieme. Experiments are being conducted on the emissions from domestic fire places. A modified version of the optical instrument developed by the Fuel Research Station, Greenwich, has been used. The authors seek opinions and information on this and on the question of separating the constituents of the flue gases, experimentally.

413. Inversions and Air Pollution. Meade, P. J. The effects of inversion layers in the creation of high concentrations of pollution is often exaggerated. Their effects depend on their thickness, temperature gradient, position, and the thermal properties of the surrounding air. Additional complications are introduced by the heights of any chimneys and the buoyancy and efflux velocity of the effluent. A number of examples are given, and it is concluded that high chimneys with buoyant effluents are advantageous, although occasional inversions would still defeat this advantage.

414. Effects of Exposure to Air Pollution on Community Health. Nose, Y. An investigation has been made of the effects of air pollution on mortality and morbidity in the city of Ube. The city of Hofu, was used as a control. The rates for a number of diseases and disorders of the respiratory and circulatory systems were found to be higher in Ube. The geographical distribution of mortality accords with the concentration of air pollution and of population, but not always with the industrial areas. There are also correlations between mortality and yearly, monthly and daily trends of air pollution. While there are other factors involved it is concluded that air pollution has at least some effect on the health of the community.

415. Observations on the Relations Between Air Pollution and Public Health. Petrilli, F. L. It is pointed out that the carrying out of efficient preventive methods is hindered by the inability to present a picture of the real and actual dangers deriving from atmospheric pollution. Public Health authorities cannot be expected to adopt expensive measures to deal with pollution unless the necessity can be strictly proved from the health point of view. Research spent to verify the effects of pollution on health will therefore be quite justified. Observations carried out in Great Britain which tend to show a correlation between mortality especially from bronchitis, and air pollution, are not borne out by Italian experience. Researches have led Italian investigators to the conclusion that in the case of lung cancer at least, cigarette smoking, motor traffic fumes, and industrial atmospheres are greater causes than general air pollution. In the light of these results it is felt that it is necessary to examine carefully evidence which seems to suggest a connection between health and air pollution. The paper concludes by suggesting the establishment of an International Centre for the Promotion and Co-ordination of epidemiological studies of the relationship between atmospheric pollution and public health.

416. Carcinogenesis by Atmospheric Pollution. Reif, A. E. The paper reviews recent studies, reports and findings on the relationship between lung cancer, cigarette smoking and air pollution, and discusses the carcinogenic hazards from radium and strontium-90 fallout from atomic bombs. The conclusion reached is that the death rate from osteogenic sarcoma caused by strontium-90 fallout to date will be relatively minor compared with the present death rate from lung cancer ascribed to conventional air pollution in cities.

417. Photography of Air Pollution, The. Scorer, R. S. The author discusses the uses of photography in air pollution observations and investigations and with the aid of examples illustrates the values, limitations and possibilities of error associated with such work.

418. Penetration of Inversions by Hot Plumes, The. Spurr, G. It is possible to calculate the heat rate required in a chimney to ensure penetration of an inversion of known height and intensity. High chimneys are essential. Chimney serving 100 MW of plant or more will penetrate the worst inversions. There is need for more information on inversions.

419. Air Pollution in the City of London. Waller, R. E. and Commins, B. T. Since 1954 measurements of air pollution have been taken at St. Bartholomew's Hospital in the City of London smokeless zone. During "smog" incidents the sulphur dioxide level is found to be higher than the smoke level when the air is still, or when there is some wind from the West (from the commercial areas). When the wind is from other directions smoke predominates, presumably carried from domestic fires. There was also a complete absence of very high levels of smoke during the winter 1958/1959.

420. Use of Transparent Scale Models in the Design of Dust Collector and Gas Duct Systems for Coal-Burning Electric Generating Stations, The. Wolf, E. F. et al. Dust collecting equipment now forms a large part of the investment in new generating stations, but the efficiency may still be low if the flue gas ducts are ill-designed. At the same time, it must be fitted into the space available. The use of transparent scale models greatly assists the design of the ducts. A specific example is given with illustrations.

421. Sulphur in the Air. Lessing, R. Apart from smoke, sulphur (mainly in the form of sulphur dioxide) from combustion is the main deleterious constituent of air pollution. A large proportion of the sulphur comes from the combustion of coal and oil. Half of the sulphur in coal is organic and difficult to remove, but much of the remainder could be removed by adequate coal preparation. Oil is also a large source of sulphur, especially the residual oils burnt as fuel. Modern processes should make it possible to remove this sulphur. A dry process is needed for removing sulphur from the flue gases of large installations. A close study should be made of the economics of obtaining sulphur from flue gases.

422. Perfect Combustion, Essential Condition for Reducing Air Pollution. Riello, P. The author discusses the requirements for smoke-free combustion in an oil-fired boiler unit. The results of a series of tests are described. A new form of refractory system is described, which, being of lighter construction, increases the speed with which the combustion chamber reaches working temperature.

423. Diesel-Oil Combustion Products: Effects of Ignition Promoting Additives on Nitrogen Oxides and Carbon Monoxide Content. Paleari, C. and Renzanigo, F. This paper gives the results of a series of experiments on the effects of an organic nitrate base additive on the nitrogen oxide and carbon monoxide content of diesel exhaust gases. The additive was shown to influence the nitrogen oxide content only when running at minimum speeds. The tests performed also showed that nitrate base additives are particularly efficient in eliminating carbon monoxide when low octane number gas-oils are used, especially if the engine runs at high load. When the fuel oil ignition properties are such as to meet engine demand, the use of these additives is more or less superfluous.

424. Control of Air Pollution in Canada, The. Katz, M. There is no federal air pollution legislation in either the United States or Canada. In Canada air pollution control is largely a provincial responsibility, with the exception of vessels and railways. The Regulations made by some of the Provinces are described, together with the rules of the Los Angeles Air Pollution Control District. The present trends in Canada are towards the adoption of the American Society of Mechanical Engineers' code of dust emission. There is also a trend towards oil and natural gas in industry, railways and vessels.

425. Photochemical Aerosol Formation in Sulphur Dioxide-Hydrocarbon Systems. Renzetti, N. A. and Doyle, G. J. The research described in this paper is part of a programme being conducted by Stanford Research Institute under the sponsorship of the Air Pollution Foundation. This programme is aimed at elucidating the chemistry of photo-oxidation, the mechanism of aerosol formation, and the properties of aerosols so produced. The work reported here covers a preliminary study of the important parameters governing aerosol formation and a cursory survey of the potential of hydrocarbon types for aerosol formation. The layout and method of use of the apparatus for radiation are described. It is concluded that sulphur dioxide plays a large part in aerosol formation in urban atmospheres containing hydrocarbons and nitrogen oxides. The observed high sulphate content and abnormally low sulphur dioxide content found in the air of the Los Angeles Basin are easily explained by the result presented in this paper.

426. Standardization of Methods of Sampling and Analysis. Katz, M. The author describes the various sampling and analytical procedures in use, especially in North America and the United Kingdom. The criteria for sampling and analytical procedures are discussed. International standardization is needed and should be sponsored by some international body, such as W.H.O. or O.E.E.C. Points which need particular attention are suggested.

427. Dust Abatement From Industrial Gases by Means of a Siren Developed by the Air Pollution Control Commission of the Polish Academy of Sciences and of the Central Institute for Labour's Protection. Maczewski-Rowinski, B. During 1952 and 1953 a series of tests was carried out at the Warsaw Central Institute for Labour's Protection using an experimental ultrasonic siren as a means of cleaning various gases and smokes. The choice of a siren was determined by a theoretical analysis of the wave intensity value necessary. It was found that a number of vapours, smokes and dusts were precipitated. A series of practical tests were made on pilot scale plant, and high collection efficiencies were obtained.

428. New Data on Maximum Allowable Concentration of Pollutants in the Air in the U.S.S.R. Riasanova, V. A. The author points out that the actions of poisonous agents on the human body become inoperative below a definite limit of concentration. This being so, it is only necessary to reduce air pollutants to below the limit at which they become harmful. Russian investigators have set out to determine these limits by conducting experiments on animals, by comparing the changes in human beings living in polluted areas with those living in clean areas, and by carefully controlled laboratory experiments with human subjects. The most rewarding of the results from the last type of experiment have been obtained by demonstrating the reaction of the bioelectric impulses in the brain to quantities of pollutants undetectable by the nose. When fixing maximum concentrations the effects on vegetation, materials and atmospheric clarity are taken into account. Also of great importance are (1) defensive reactions of the body (showing that conditions are not at the optimum), (2) that any stimulant is undesirable if it operates against a person's free-will, (3) the maximum permissible concentration should be set by reference to the most sensitive index. On the basis of these considerations a tentative table of maximum concentrations for 30 pollutants has been produced and is appended to the paper.

The Faraday Society

The Faraday Society announces that in September 1960 it will be holding a " General Discussion," for which papers are invited, on the subject of " The Physical Chemistry of Aerosols." Full particulars will be issued in due course, but in the meantime further information can be obtained from the Society at 6 Gray's Inn Square, London, W.C.1.

The R.S.A.

The programme for the winter session, 1959-60 of the Royal Society of Arts contains several lectures of interest to readers of this journal. They include three Cantor Lectures (February 15th, 22nd and 29th) on " Some Aspects of the Fuel Industries," by Dr. Albert Parker, and three lectures on " Energy "—the generation, transmission and retail distribution of electrical power—on May 9th, 16th and 23rd. On November 25th there was a lecture on " Power Production and Transmission in the Countryside," by Sir Christopher Hinton, Chairman of the Central Electricity Generating Board.

Boys Help to Measure Pollution

Senior boys at Whiston County Secondary School are helping to measure smoke pollution. Three fourteen-year-old boys have begun operation of testing equipment supplied by Whiston Public Health Department. Their science master, Mr. T. Fairclough, has said " The boys are very keen on operating the equipment. They will do it on a fortnightly rota basis. Apart from being a valuable chemistry lesson, it teaches them just how dirty is the air we breathe. They should grow up to be clean air conscious."

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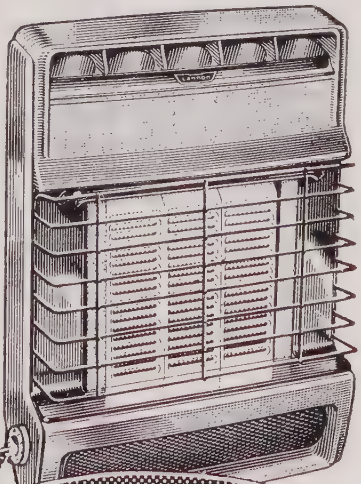

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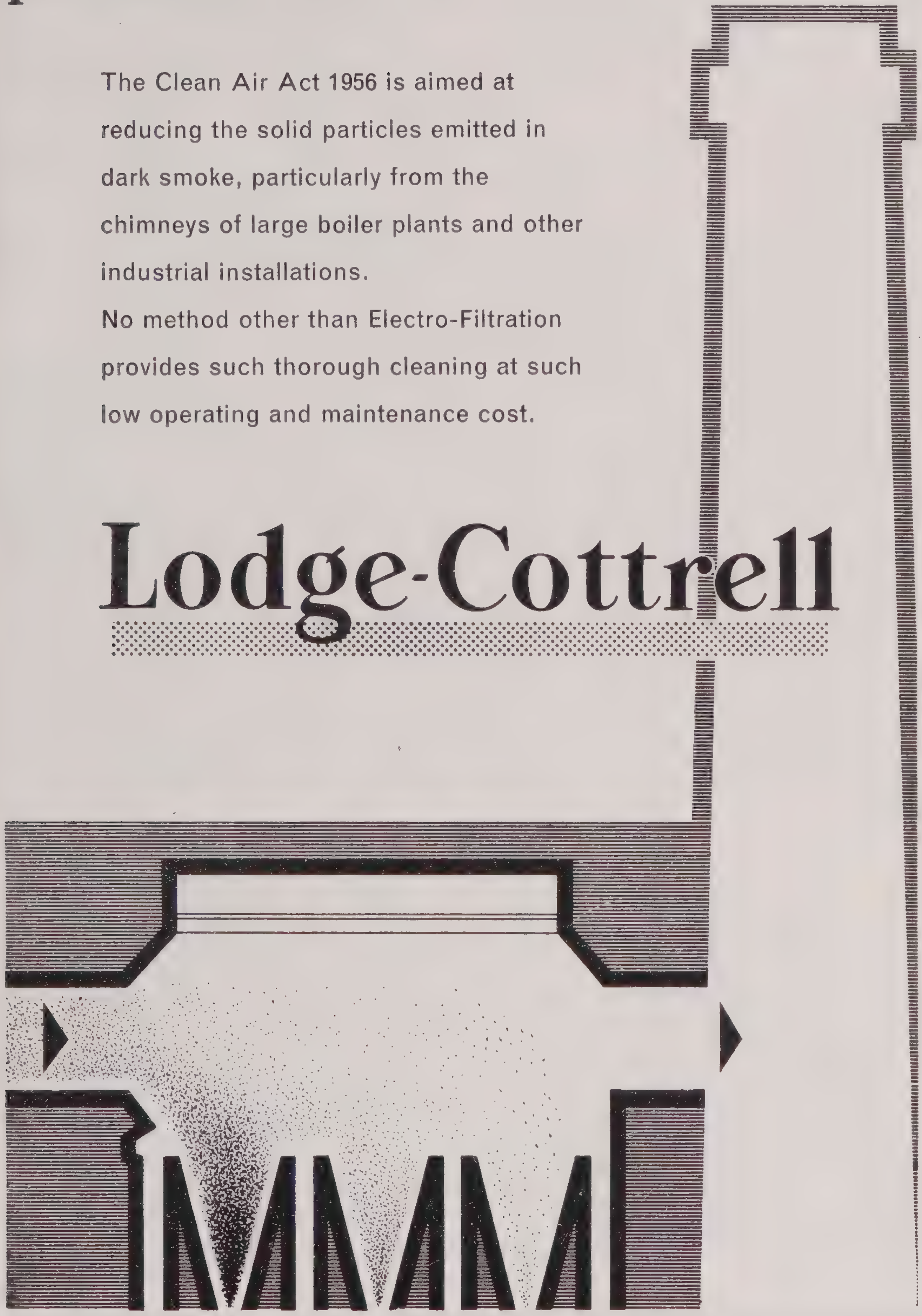

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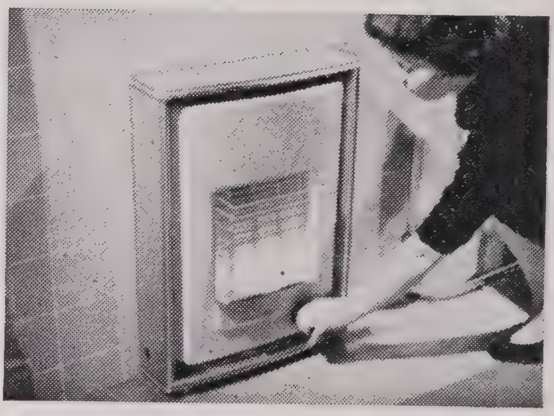

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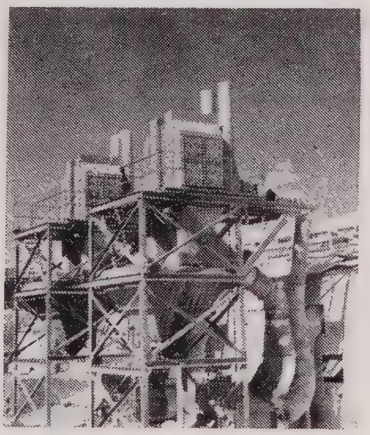
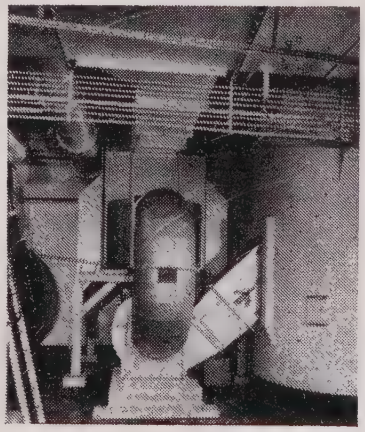


Mancuna-Dustex D584 Cast Iron Miniature Cyclone Dust Collectors operating with Rotary Driers on Limestone



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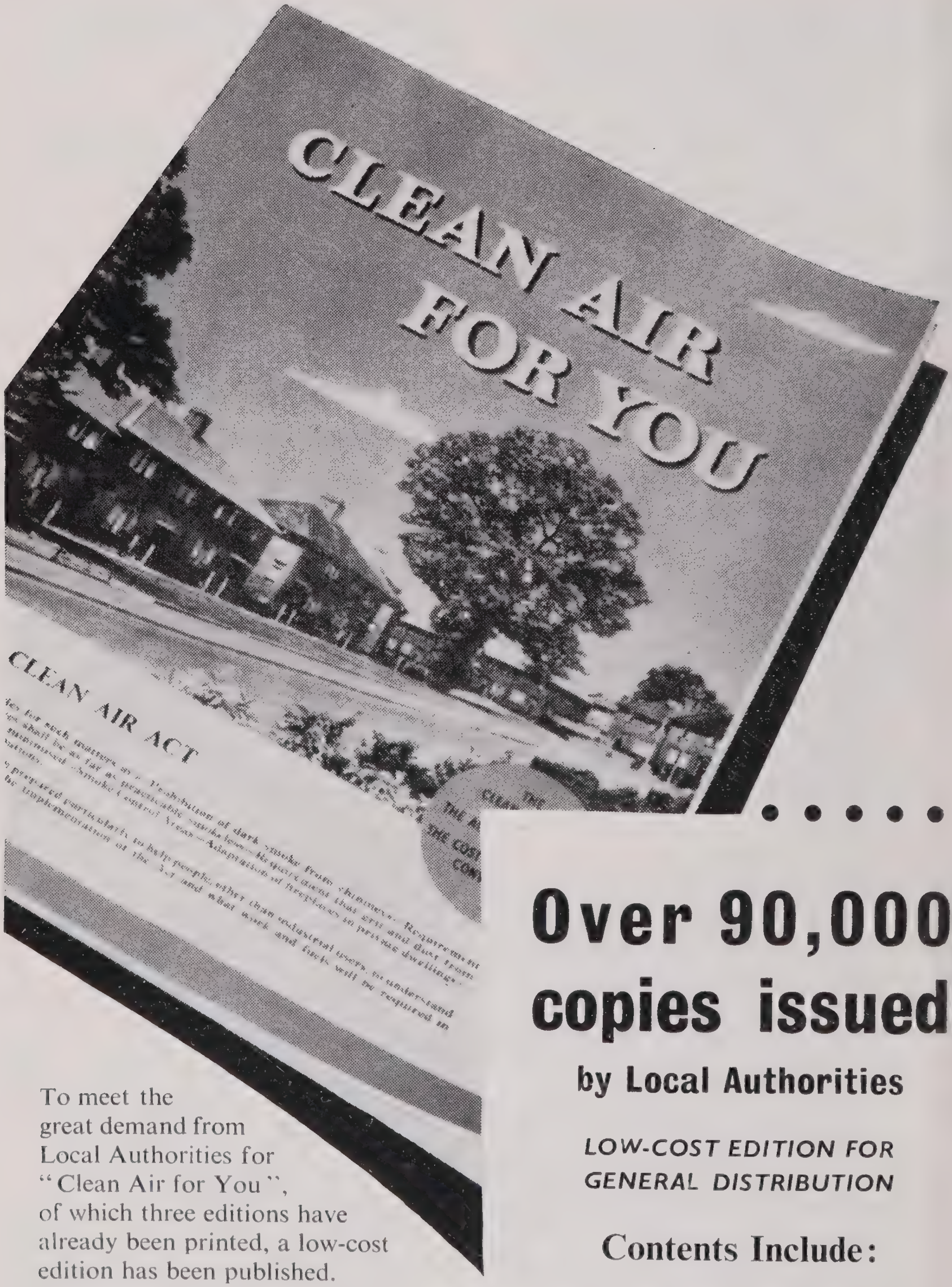

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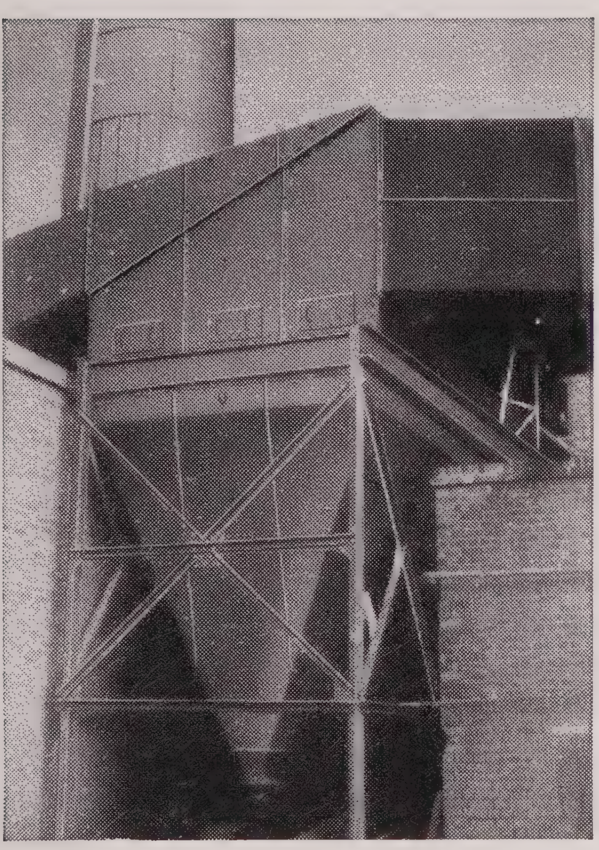
S.34

SOLID SMOKELESS FUELS FEDERATION . 74 Grosvenor Street, London, W.1.

What are "practicable means"?



THE CLEAN AIR ACT of 1956 states that certain combustion processes " shall use any practicable means " to minimise the emission of grit.

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We can claim wide experience in this field and would be pleased to place our services at the disposal of industry for all grit and dust collecting applications.

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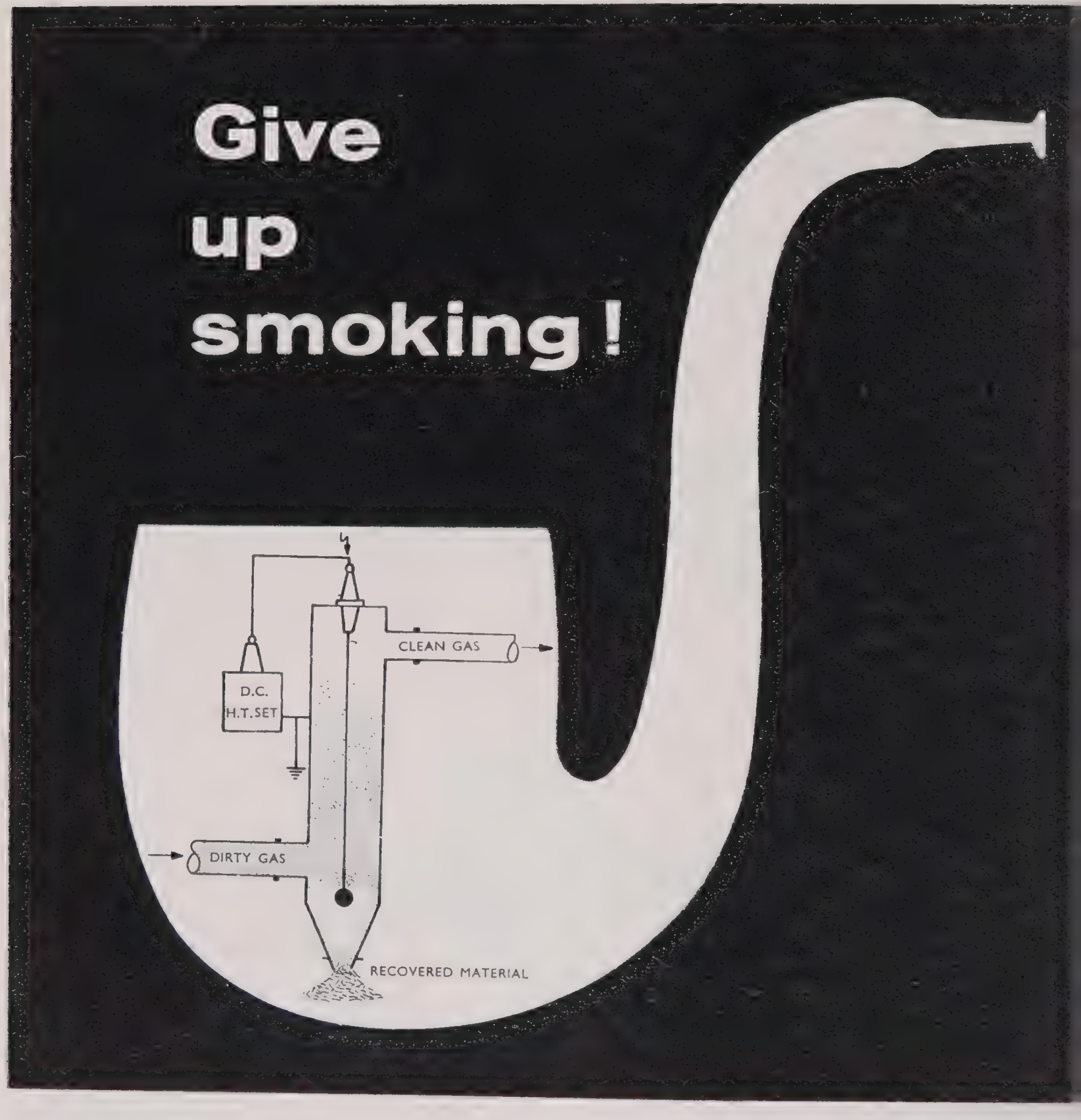

You can't afford smoke nowadays—it's bad for you and it's bad for oth people too. For clean air you need the very best in electro-precipitatio That is what our extensive research and development resources, backed unrivalled experience, can give you. Pollution from the chimneys of pow stations, iron and steelworks, chemical plants and other industrial plants over the world has been cut to a minimum by our high-efficiency electr precipitation. It's time your chimneys, too, gave up smoking!

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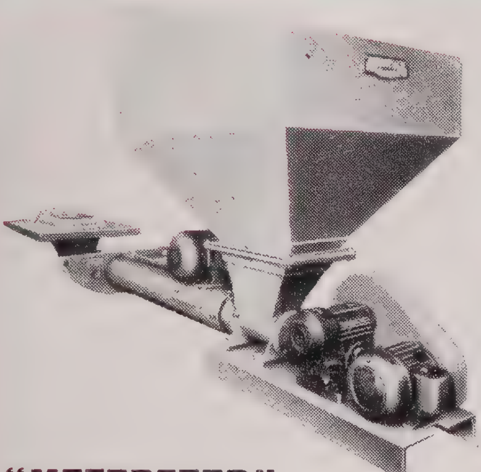
COAL-Mechanical Stokers

and the

CLEAN AIR ACT

As recently announced in the press, a new ministerial order permits the installation of mechanical coal burning equipment in Smoke Control Areas. It follows that the most modern and efficient plant should, of course, be installed on the lines of the latest Hodgkinson boiler house equipment.



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This stoker has separate drive and fan motors which our "Custodian" Panel controls by cutting in the fan at a predetermined period before the drive and cutting out the fan after the drive has stopped.

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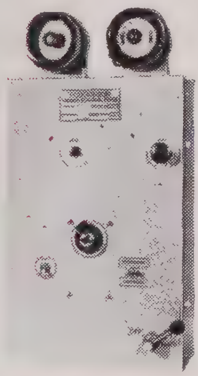

NEW "CUSTODIAN" CONTROL PANEL

The combination of the "Custodian" panel with the "Meterfeed" Underfeed Stoker operates as a highly efficient guarantee against the production of smoke and its consequences under the Clean Air Act.

NEW HODGKINSON 8″ UNIVERSAL COAL ELEVATOR

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SMOKELESS AIR

JOURNAL OF THE
NATIONAL SOCIETY FOR CLEAN AIR

No. 113 ★ SPRING 1960 ★ 2/-

In this Issue

Questionnaire on the Working of the Clean Air Act ★ Mr. Brooke on Progress to Clean Air ★ Coal Merchants' Offensive ★ A.P. in Czechoslovakia ★ Mechanical Stokers ★ Automatic Coal Burning Equipment in U.S.A. ★ Clean Air Crossword, etc.

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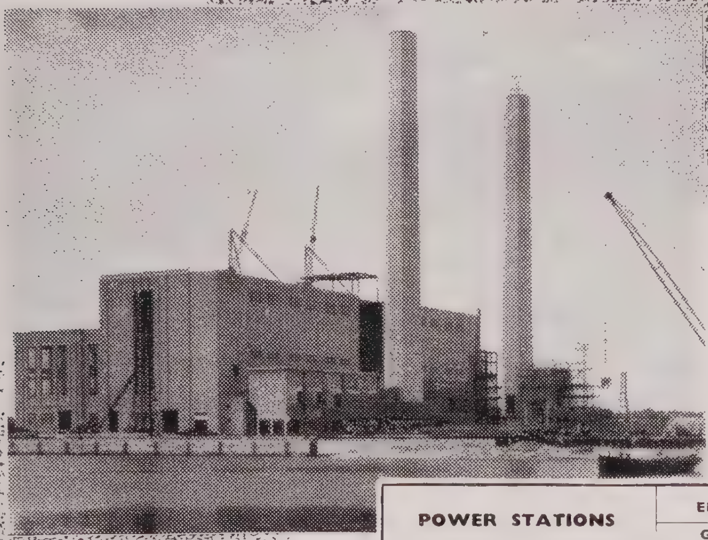

POWER STATIONS	EMISSION IN GRAINS/CU. FT. AT N.T.P.	
	Guaranteed	By Official Test
Blackwall Point	0.17	0.076
Bold	0.20	0.062
Braehead	0.20	0.031
Carrington A	0.18	0.065
Carrington B	0.21	0.21
Clarence Dock	0.20	0.099
Cliff Quay (E.C.R.)	0.13	0.056
Croydon B	0.17	0.164
Dunston B	0.35	0.16
Hams Hall B	0.23	0.14
Kingston upon Thames	0.06	0.04
Kirkstall	0.20	0.05
Leicester	0.30	0.21
Meaford A	0.162	0.053
Poole	0.14	0.062
Plymouth B	0.18	0.16
Roosecote A	0.20	0.024
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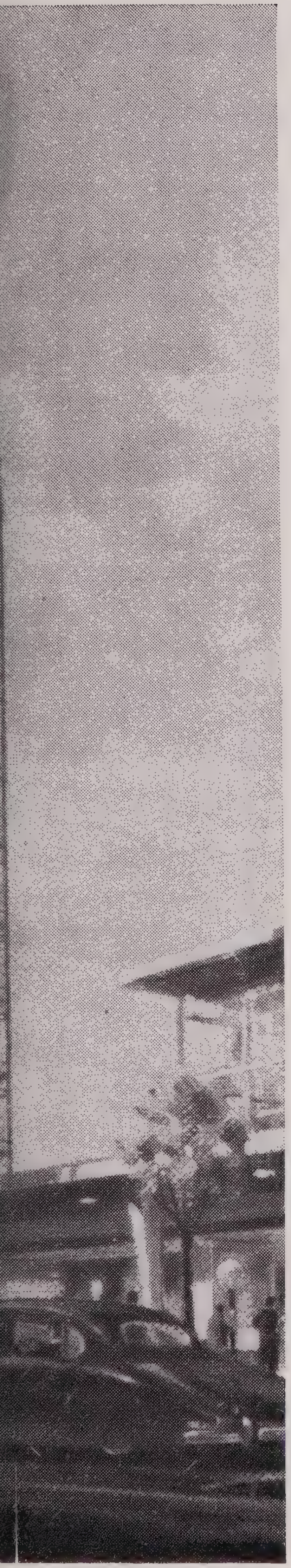
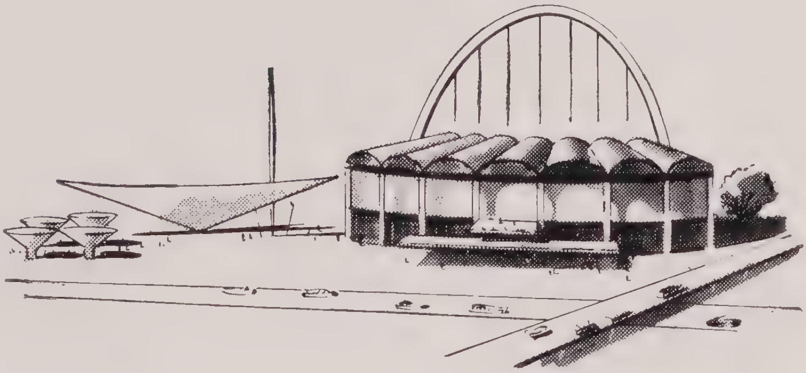


Tomorrow



Today gas-fired central heating systems and forced fanned warmed air systems are being increasingly installed in all kinds of buildings. And Gas research, coupled with an excellent consumer service, ensures that tomorrow gas will be even more the preferred fuel for cooking, space heating and water heating . . . **AND TODAY**—every industry and 12 million homes use **GAS.**

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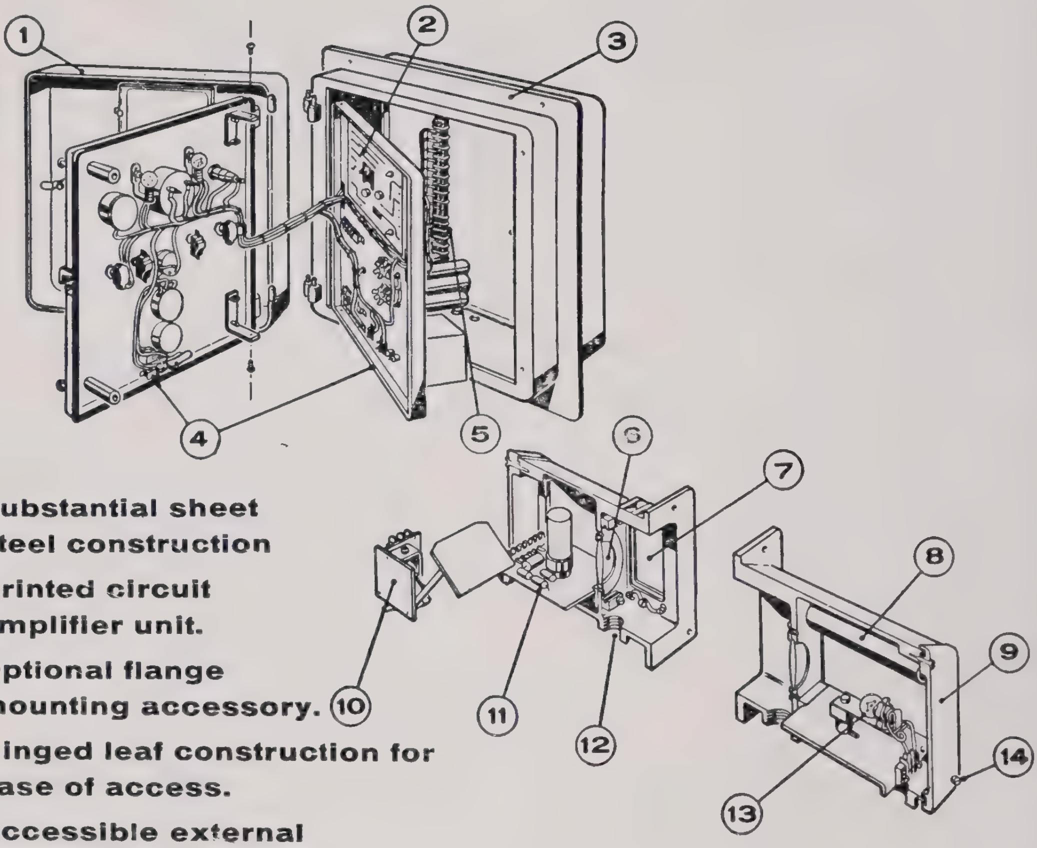
Now—you can ensure* against clean air act



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Manufacturers of the world's widest range

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The Lancashire Dynamo Smoke Alarm protects you by warning when the Clean Air Act smoke limit is exceeded.

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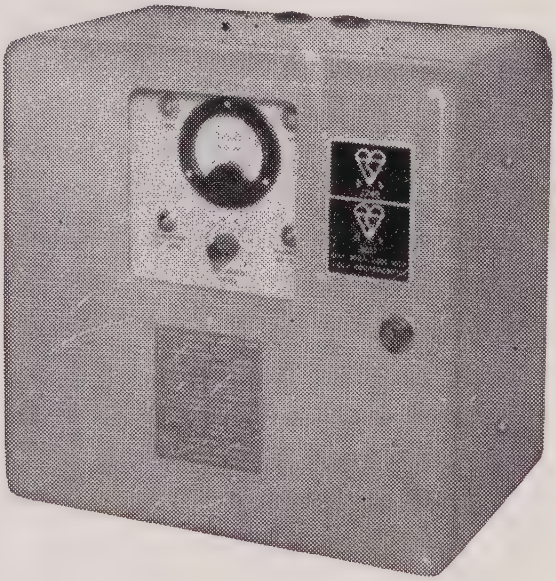
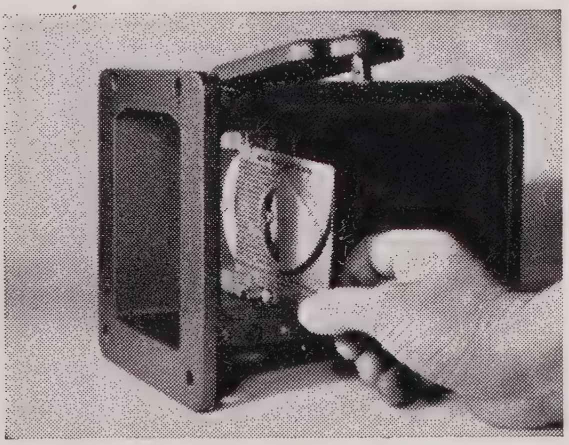
* This equipment is the first of its kind to carry the British Standards Institution's "Kite Mark", which indicates independent certification of compliance with BS.2740/56 or, plus the appropriate indicating instrument, with BS.2811/57.



Main unit showing locked away controls and calibration meter.



Calibration check by manual insertion of check slide.

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Yes, but I suppose the supply of smokeless fuel for open fires is the limiting factor, isn't it?

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3 Work automatically with boiler draught without "repair or renewal".

*The cost (including fitting) for a *Lancashire Boiler is well under £300 and we fit on a basis of "no cure—no pay".*

**Can be fitted to handfired, automatic sprinkler or shovel stoker.*

clean air act

The Iron Fireman coal-burning Automatic Stoker will solve the problem of Smoke without the use of expensive fuels. The recognised method of burning bituminous coal is to use under-feed stokers, which are now an exempted class of appliance under a recent order made by the Ministry. Iron Fireman Stokers are thus being installed in many Smoke control areas throughout the country.

Iron Fireman

"FIRST AND FOREMOST"

Automatic Coal Stokers

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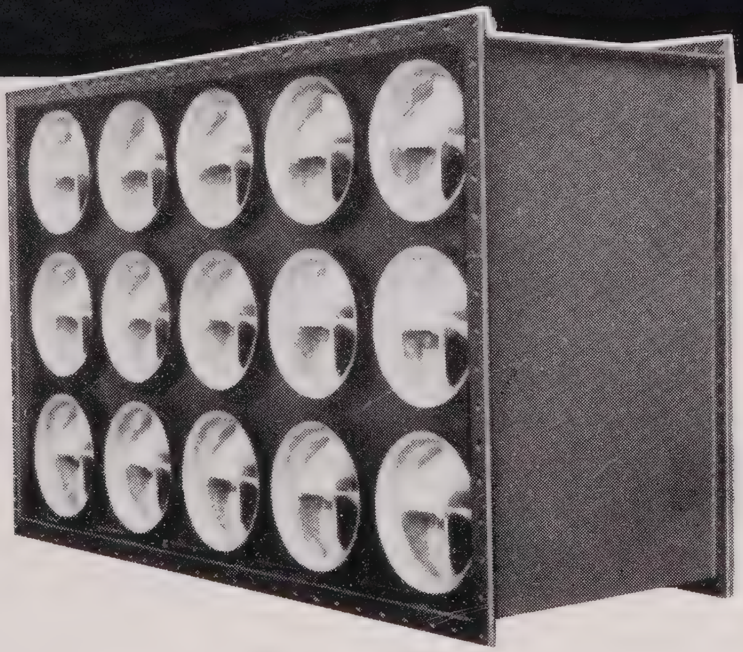
"R" Type
DUST COLLECTORS



- Specially designed for use in the smaller industrial Boilerhouse.
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- Preparing for Dust Removal (reprint)
- High Efficiency Filtration for CO_2 Gas Cooled Nuclear Power Stations and Radio Active Dusts.

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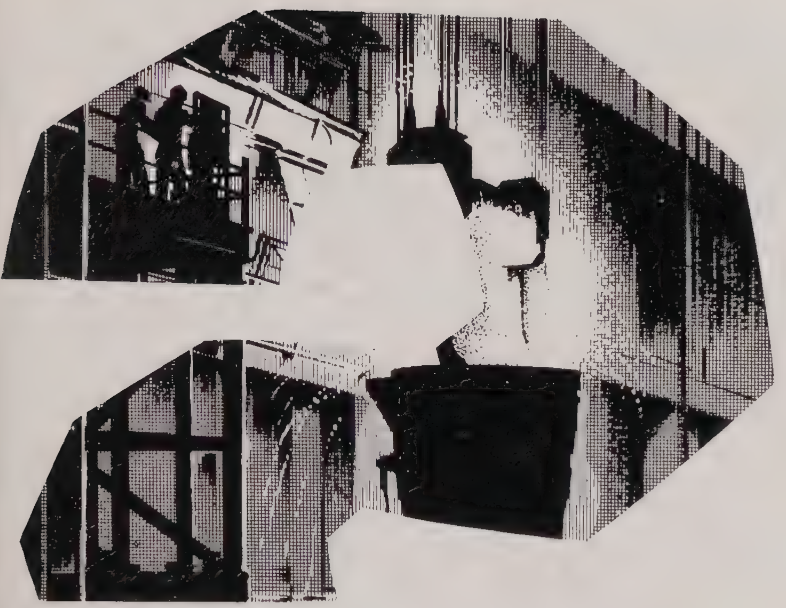

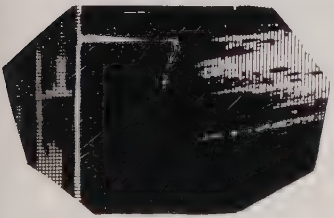

PROJECTS MEAN PROBLEMS

Projects in the steel industry are no exception. And among the problems posed by the new processes and new schemes which are exciting the steel world today, gas cleaning and dust collection loom large.

Tonnage-oxygen practice on steel furnaces—the L.D. process on converters—bigger and better sinter plants—these new developments demand higher standards of performance from gas-cleaning and dust-collecting equipment.

Which of the various types of equipment available will provide the best answer to these problems and to others as they arise? Which will give the most efficient, most economical long-term service?

If *you* have to find the answer to these questions, remember that whatever conclusions theory may point to, the practical yardstick is that Simon-Carves Ltd. have first-hand operational experience, with the first open-hearth furnace precipitators in this country now in operation, and a repeat order in hand. They have also received the first order for an L.D. converter precipitator in this country, and are installing sinter gas precipitators in two European steelworks.

Future problems will best be tackled by the firm with field experience gained from full-scale plants in actual service—by the firm which has established a clear lead in electro-precipitation for modern steelmaking processes in this country. For further information write to CPP Division (S.A.) at address below.

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SC226

For Local Authorities promoting

★ ★ ★ ★ ★ ★ ★ ★ ★ **CLEAN AIR**

SMOKE CONTROL AREAS

The Solid Smokeless Fuels Federation is a non-commercial organisation, its work being educational and advisory. It is one of the organisations listed in the Ministry of Housing and Local Government memorandum on Smoke Control Areas from whom advice can be obtained on suitable appliances, their correct installation and proper operation, and the correct type of smokeless fuel to be used in Smoke Control Areas established by local authorities under the Clean Air Act.

For further information and examples of the full range of free informative literature, apply to:

Under the Clean Air Act, powers are given to local authorities to arrange for Clean Air Exhibitions, etc., and to promote educational campaigns to get public support in abolishing smoke and air pollution. Services of this kind have been provided for local authorities by the S.S.F.F. since its formation in 1944. The Federation has either organised or participated in Clean Air campaigns up and down the country. The S.S.F.F. exhibition stand and two mobile exhibition units displaying the full range of solid smokeless fuels, and approved appliances actually burning the fuels, are prominent features of these campaigns.

SOLID SMOKELESS FUELS FEDERATION
74 Grosvenor Street, London, W.1. *MAYfair 3327*

SSFF

National Society for Clean Air

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MEMBERSHIP of the Society is invited and is open to individuals, local authorities, firms and other corporate bodies. Full details and membership application forms will be sent on request.

ANNUAL GENERAL MEETING

An Annual General Meeting of the Society will be held at the Caxton Hall, London, S.W.1, at 11.30 a.m. on Tuesday, May 17th, 1960 (*see note on page* 174).

In the afternoon of the same day, at 2.30 p.m., will be held a discussion meeting in the form of a Symposium on "Public Relations in the promotion of Smoke Control Areas."

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SMOKELESS AIR

Vol. XXX No. 113 Spring 1960

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Ships, towers, domes, theatres and temples lie
Open unto the fields, and to the sky ;
All bright and glittering in the smokeless air.

SMOKELESS AIR

THE WORKING OF THE CLEAN AIR ACT

A Questionnaire

THE Society is making an extensive inquiry into the working of the Clean Air Act by means of a Questionnaire addressed to all local authorities administering the Act, both in England and Wales and in Scotland. It should be in their hands by the time these notes are read.

The purpose of the inquiry—which incidentally has been drawn up on the advice of local authority representatives on the Society's Executive Council—is to ascertain how well the Act is working in practice, to what extent the various provisions are being used, and how effective they are. The questionnaire is straightforward and can be completed without difficulty. It asks for simple statistical information on the main provisions of the Act, with a few questions asking for comment or other written information.

It is intended to report on the returns to the questionnaire at the Harrogate conference, in October, when two full sessions will be devoted to the presentation and discussion of sectional reports. Although details will not be made final until the replies begin to come in and to be analysed, it is probable that there will be main reports, introduced by different speakers, on the industrial sections and on smoke control areas, with perhaps additional reports and summaries. The information that should be obtained is certain to be of considerable interest and much of it may be of importance. A good, all-round discussion should ensue, and it is hoped that representatives of industry will be present at the conference and will be willing to participate in the discussion.

We appeal to all our local authority readers to do what they can to help the inquiry to be a complete success. It is one of the most important enterprises yet undertaken by the Society.

Other Harrogate Arrangements

Among other arrangements for the Harrogate conference (October 5th to 7th) we are pleased to be able to announce that the Des Voeux Memorial Lecture, on the rather neglected but vital subject of " Clean Air, Public Opinion and the Press," will be read by Sir Linton Andrews, Editor-in-Chief of the *Yorkshire Post*. Not only is Sir Linton one of the most distinguished of living editors, but he has become more widely known—and honoured—as the first Chairman of the Press Council, an office from which he has recently retired.

Many members will be glad to know that another session is to be given to papers and discussions on the growing problem of pollution on the roads. It is intended to deal with this from the practical standpoint of preventive action, rather than to consider its nature and effects, or even its extent. The opening paper will be by Mr. Douglas Lister, Chief Health Inspector for Northumberland County Council, whose close study of this problem led to an outstandingly valuable and lucid thesis for which he was awarded the Fellowship of the Association of Public Health Inspectors. Further contributions are being arranged.

Open Session

The remaining conference session is to be given over to papers or reports on technical, research and other developments for the promotion of clean air. An open invitation to subject such contributions, subject to conditions which may be obtained on request, is extended to all who may be interested. This open invitation follows the success of that made for last year's International Conference, although this year we expect only a relatively few " home " papers. If it can be repeated with success it may become an important regular feature of the Society's conference and recognized as the occasion on which progress can be made known to the world.

The Clean Air Exhibition being arranged in conjunction with the conference is already assured of success, and the amount of space reserved one month after details were sent out exceeded by a good margin the total space of the exhibition at the International Conference last year. It will be held in the excellent new exhibition building, adjoining the Royal Hall, in which the meetings will be held. Formal invitations for the conference will be going out in May. In the meantime early hotel reservations are advisable, and information about accommodation in Harrogate will be sent on request to any reader.

Annual General Meetings

The annual general meeting, held in London on December 11th last, was well attended, and as reported on another page it was followed in the afternoon by a joint discussion meeting with the South East Division. Sir Hugh Beaver was the only nomination for President, and he was therefore re-elected for a second term of office. Members will be glad to learn that he is fit again and active for clean air. The only nomination for Hon. Treasurer was Mr. Stanley E. Cohen, who was thus also re-elected. (Mr. Cohen has recently been elected as Chairman of the City and Port of London Health Committee). Re-election was not necessary for the Senior Vice-President, and Sir Graham Sutton therefore continues in this office.

The newly-elected Executive Council met after the meeting, when Mr. John Innes was elected Chairman, Dr. Burnett retiring after the customary two years of service. Dr. J. L. Burn was re-elected as one of the two Deputy Chairmen, and as the other, in place of Mr. Innes, Mr. James Goodfellow was elected.

At the annual general meeting it was reported, with approval, that the Executive Council had agreed that it was desirable to change the Society's financial year to start on January 1st instead of July 1st. The main reason for this is that major items in the accounts are now the conference and exhibition income and expenditure, much of which occurs during the summer months and is cut across, confusingly, by the change of financial year. The accounts will give a much better picture of the actual financial position under the new arrangement. To make the change over there will be a half-year financial report for July 1st to December 31st, 1959.

One important consequence of the change is that it will be desirable to hold the annual general meeting in the early part of the year instead of the autumn, at the annual conference. This may cause some regret, although it is generally agreed that the two did not mix quite satisfactorily. Moreover, the holding of a meeting for an address or discussion, or some other function, in conjunction with a Spring A.G.M. will remove the criticism that the Society is only a " once a year " organization. The Society is now big enough, and its work is important enough, to make rather more than this appropriate.

Coalmen's Clamour

Elsewhere we give a report on some of the most recent propaganda instigated by the "Clean Air Advisory Service" set up by the Coal Merchants' Federation. The development of the movement is not only regretted by the more far-sighted members of the coal trade, but is causing increasing resentment among local authorities, both because of the misleading nature of the propaganda and the manner in which it is being conducted. It is undoubtedly causing the loss of goodwill and has started talk in local authority circles about the possibility of municipalizing retail solid fuel distribution. Quite divorced from ordinary political or economic considerations, this idea could develop and become a new factor in the situation the merchants are trying to create. We hold no brief either for or against some form of public control of the trade, but clearly if the Clean Air Act is to be stultified by deliberate opposition something may have to be done. And the merchants will have no one to blame but themselves.

Their plea that they do support the Clean Air Act but wish it to be applied sensibly hardly tallies with the propaganda being put out—that domestic smoke is not important, that smokeless fuels are harmful, that smoke control areas will increase the rates and spread fly-borne disease, and that the real danger is from sulphur dioxide or alternatively diesel fumes. The seeking of information for "co-operation," and then using it to foment opposition seems hardly the way to promote the useful discussion of any real problems that may exist, nor is the promotion of petitions. It is reported that merchants or their representatives have themselves been going round seeking signatures to petitions, and one authority tells us of a call at the home of a man and wife who want a smoke control area. They were out but the fifteen-year-old son was induced to sign his name on the form!

This sort of thing is not going to help the trade in the difficulties it is likely to find increasing as a result of its inability to adapt itself to new conditions. Two morals—at least—may be drawn from it all. First, local authorities should examine very closely indeed all offers of co-operation from the trade. Some may be genuine, and co-operation is indeed desirable, but it is just as well to be cautious. Secondly, the local authorities about to embark on smoke control schemes should give more thought to, and if necessary substantially step-up, their own publicity, right from the beginning. Publicity here includes good public relations, and we are afraid that sometimes it has been taken for granted that the general public understand the case for clean air more clearly than they do. The Act gives authority for such work and its importance cannot be over-emphasized.

Cold Comfort

The coal merchants will find cold comfort in two items of news reported in this issue. There is the Minister of Housing's most recent speech, in which he declared, "I intend to maintain relentless pressure in all areas where there is a smoke problem," and there is the extract from the Fuel Research Report for 1958. This shows that "in the vast majority of towns"—i.e., with a population of 5,000 and upwards—the smoke concentration falls within similar limits, which are roughly ten times that found in a few rural or coastal areas. A smoke distribution map (which we hope to reproduce later) shows not only the familiar "black areas," but the far more numerous black spots that have a smoke problem. There is also the valuable evidence that the benefit from a smokeless zone or control area, even when it is isolated, is considerable, as witness the City of London with its 40 per cent. reduction in smoke. The more the problem of smoke (as distinct from other pollution) is studied the more serious and ubiquitous does it appear.

Mr. Brooke on Progress to Clean Air

Minister's Confident Speech

The Minister of Housing and Local Government, Mr. Henry Brooke, M.P., gave the following address at a meeting in London on February 3rd, 1960

THERE was an astonishing and splendid change in public opinion about air pollution during the 1950's. Before the war, despite the propaganda efforts of dedicated bodies such as the National Smoke Abatement Society, little effective was done. Dirt in the air was thought of as an essential concomitant of modern life in big towns. Those who inveighed against it were met with the inertia of a public which did not really believe that things could be changed; and no one wanted to risk higher unemployment by putting up the costs of industry. It was the tragic smog experience of London in December, 1952, when 4,000 people died through the aggravation of bronchial trouble, that started to convince people that something must be done.

Mr. Macmillan as Minister of Housing and Local Government, set up a Committee to make recommendations for remedying air pollution, and he took the significant step of inviting a leading industrialist, Sir Hugh Beaver, to be Chairman of it. That Committee produced a unanimous report in 1954 which startled the country by estimating the sheer economic cost of air pollution—quite apart from the damage to health—at certainly not less than £250,000,000 a year. The Committee reported that remedial action was bound to take effect gradually, and judged that it would be at least 15 years before reasonably satisfactory air conditions could be restored. It laid down a plan of campaign, based on the proven fact that a little more than half the pollution comes from domestic chimneys and a little under half from industrial smoke, fumes and grit. The case presented by the Committee was overwhelming and the Government decided to act.

On the health side it was only too clear that dirt in the air, by depriving people of sunshine and natural light, reduces their normal resistance to infections. In times of smog the statistics show that deaths from bronchitis and other chest complaints go up enormously. But it is not only the smogs we need to worry about. Every winter in quite ordinary conditions in smoky towns chest complaints develop and are worsened by the dirt in the air. Besides that, the economic cost of £250,000,000 a year does not include all the extra drudgery which falls on millions of women in trying to keep their homes clean. Fortunately, the new public interest aroused by the smog coincided with the time when fuel economy was highly important to industry. A lot of air pollution originates in wasteful use of fuel. Fuel which is not effectively burned goes up the chimney in smoke; so dirt and waste are linked.

The Government's Clean Air Act, piloted through the House by my predecessor, Mr. Duncan Sandys, reached the Statute Book in 1956. Its provisions relating to industrial smoke, grit and dust, were brought into force by me on June 1st, 1958. They prohibit the discharge of dark smoke from chimneys, except for certain short and unavoidable periods. They require grit and dust from furnaces to be properly controlled. There is a five year transitional period during which it is a defence to show that it has not yet been possible to install modifications to existing plant which will enable it to comply with the Act. But since 1956 no new plant or furnaces can be installed which do not comply, and the transitional period will run out in the summer of 1963.

The Alkali Acts

On the industrial side the Clean Air Act links up also with the Alkali Acts. The earliest Alkali Act was concerned with the noxious fumes from alkali works making soda out of common salt by the Leblanc process. Leblanc, who was physician to the Duke of Orleans, invented this process and built a works in France in 1791. The Duke was guillotined and the works closed, and the leaders of the Revolution offered Leblanc the choice of disclosing the secrets of his process or being guillotined too. He chose disclosures. Early in the nineteenth century the process was brought over to England, but it let loose hydrochloric acid gas in large quantities which made alkali works highly unpopular throughout the neighbourhood. By degrees possible means of reducing the nuisance were developed, and a Royal Commission led to the first Alkali Act in 1863, applying to soda works only.

But there were many other chemical processes which were bad neighbours too, and subsequent Alkali Acts have brought into existence a general control, enforced by inspectors responsible to me, over the discharge of noxious or offensive gases from a variety of processes. All my Alkali Inspectors are qualified and experienced in chemical engineering, and have the responsibility for dealing with the more intractable problems of control of air pollution from industrial processes that give rise to problems of special difficulty. But as I have said, rather more than half the pollution in the atmosphere comes not from industry but from the smoky coal used in ordinary household grates and rising from ordinary domestic chimneys.

Smokeless Zones

Well before the coming of the Clean Air Act, a number of local authorities took powers under local Acts to create smokeless zones. The City of London were pioneers in this. The City Corporation took powers to declare the whole of the City a smokeless zone, and this has been in operation since the end of 1955. There are only some 5,000 people living in the City at night, but something like 350,000 people work there during the day. If on a cold autumn or early spring day you stand on the roof of one of the high buildings in the City, as I have done, you can see the contrast between the clearness of the air over the City and the smoke pall created by domestic chimneys over the neighbouring parts of London beyond the City boundaries. The Clean Air Act prohibits dark smoke from industrial furnaces, but as regards smoke it empowers each local authority to establish what is called a smoke control area. In a smoke control area the use of ordinary house coal which produces smoke is forbidden. People must heat their houses either by gas or electricity or oil or by some smokeless solid fuel such as anthracite or patent fuel or coke.

One Tenth of the Way

Grants are given from public funds of 70 per cent. of the cost of replacing an ordinary grate by a new kind of heating or a new grate that will burn smokeless fuel successfully. Obviously there is no point in establishing smoke control areas outside smoky towns, because that would only use up Exchequer money and smokeless fuel unnecessarily. Out of the 1,500 local authorities in England and Wales some 300 are in what are called the " black " areas. Out of these, nearly 200 have by now started to make the whole of their district a smoke control area. Usually they begin on a part of the town. Up to the end of 1959, I had confirmed 195 smoke control orders made by local authorities, and 117 of them were already in force. A further

90 orders have been put up to me and are under consideration. Another 225 proposals have been notified to me provisionally. This makes a total of 510 schemes, of which 140 acres are in Greater London. The area covered by these 510 schemes is 105,000 acres, and they include about 600,000 premises. I estimate that there are some 8,000,000 premises that ought eventually to come within smoke control areas, so up to the present we have firm plans that take us nearly one-tenth of the way.

I am not despondent about progress, but I am not content. From now on it has got to be a great deal more rapid. That was why I sent a circular to local authorities early last year asking the 300 councils whose districts were in the " black " areas to make faster progress, and to prepare and submit to me a phased programme for establishing smoke control areas over the next fifteen years. Most of the local authorities in the great built-up areas of the country have now done this, and at the Ministry we are working on the programme they have sent in. I intend to maintain relentless pressure on all those areas where there is a smoke problem, because I am certain that public opinion wants the responsible authorities to act. The simple fact is that we can get rid of a great deal of the air pollution we suffer from by intelligent use of our present technical knowledge. It is possible to stop dark smoke from furnaces by ensuring proper combustion efficiency. The British public enjoys open fires, and can continue to enjoy them by burning smokeless fuels; or people can change to gas, electricity or oil.

As regards some industrial processes, our technical knowledge is not yet adequate to effect a complete cure. In all these cases research and development work is being pressed ahead. There is no reason at all why we should not get rid of the greater part of all smoke pollution within the next ten years. It is a tremendous task, but the Government wants it and the public wants it, and if we all work together we are bound to win.

For 100 years we have taken for granted that towns and cities must be dirty: it is not true. What we are now setting ourselves to do is to make our towns and cities cleaner and healthier places than they have ever been since the Industrial Revolution began. But like so much else, this glorious aim cannot be reached by Government action alone. Success will only come if we all work as one, and all are prepared to change our old methods of doing things, if necessary, for the general good. Then, ten years hence, people will be asking why anyone ever tolerated smoky chimneys, dirty windows, dirty paint and yellow London fog.

Dr. E. T. Wilkins, O.B.E.

Dr. Ernest Thomas Wilkins, of the D.S.I.R., needs no introduction to readers of this journal for his work at the Fuel Research Station (and now at Warren Spring) on the measurement and other investigations of air pollution. The increase in this work in recent years has been tremendous, and a great deal of the burden has fallen on Dr. Wilkins. It is therefore with pleasure that we record his appointment as an Officer of the Order of the British Empire in the New Year's Honours List.

" Public Health "

The January, 1960, issue of *Public Health*, the journal of the Society of Medical Officers of Health, is devoted to respiratory diseases. Two of the four contributions are by leading members of the N.S.C.A.—an article by Dr. J. L. Burn, Deputy Chairman, on " Chronic Bronchitis," and one by Dr. J. S. G. Burnett, Immediate Past-Chairman, on " Atmospheric Pollution—the Present Position." There are also articles on " Cancer of the Lung—a Public Health Problem? " by Dr. James Cuthbert, and " ' And Now Where '—Respiratory Disease and the Future," by Dr. Frank J. Welton.

Coal Merchants' Offensive

The Blameless Coal Fire

THE nature and tactics of the opposition to the setting up of smoke control areas by coal merchants and their organizations, reported in recent issues of this journal, are becoming increasingly evident. Press reports and correspondence with local authorities show, without doubt, and despite hollow protestations to the contrary, that the aim of the campaign is to hinder and delay as much as possible the implementation of that part of the Clean Air Act concerned with domestic smoke.

Examples of the activities that have been noted are the issue of press advertisements, belittling the seriousness of the domestic pollution; the issue and distribution of leaflets to householders in proposed control areas which can have no other purpose than to provoke opposition to the proposals; the drawing up and distribution of forms of petition against proposals, or stimulating a demand for a Public Inquiry; organizing the collection of signatures, and either organizing or co-operating in the holding of meetings of protest (addressed perhaps by an " authority " on clean air).

In at least one region detailed information about plans for smoke control areas was sought from local authorities, in a reasonable and " let's co-operate " kind of letter, the ostensible purpose being to assist local merchants in planning ahead for changes in demand. All very reasonable—except for the fact that the information so gained has at once been used to organize a campaign against smoke control in the proposed areas.

It may be useful to look at some of this propaganda activity in more detail.

In the first place there is usually the declaration about supporting the Clean Air Act, wishing to help it to succeed, and only objecting to smoke control areas where they are considered (by the merchants) to be unnecessary or, as one of their officials put it, " senseless." It is true that it would not be desirable (for a long time ahead) to promote smoke control in the "white" areas, and in fact there has been no attempt on the part of the local authorities in these areas to rush in with schemes. In any case all proposals have to be approved by the Minister of Housing and Local Government (or in Scotland, the Secretary of State), and there is undoubtedly consultation in respect of fuel supplies with the Ministry of Power. Any " senseless " scheme would be quickly vetoed without the interference of a vested interest. What the merchants are doing, of course, is to try to kill schemes that they believe *will* be approved by a Minister who is carrying out a duty laid upon him by Parliament.

They are, in effect, claiming that they are the judges of how and to what extent the expressed wishes of Parliament should be carried out. This may be legal, it may even—like so much that isn't—be claimed to be democratic, but some might describe it in a harsher way.

After claiming to be in favour of the Act the propaganda usually continues by suggesting that domestic smoke is not important anyhow. The argument that has been examined previously in these pages is invariably used—that domestic smoke is less than 10 per cent. of the total pollution of the air. This is based on the table of pollutants that was published in the Beaver Report, but is quite irrelevant to assessing the harm and damage done by domestic smoke. An article on another page examines the factors that account for domestic smoke being the most serious factor in all atmospheric pollution.

Domestic smoke having been dismissed, other forms of pollution are high-lighted. One of the leaflets (N.W. region) puts the question, " Will air pollution be greatly reduced by prohibiting emission of smoke from the domestic chimney? "

This is the answer:

> " Definitely not. The non-visible health-impairing pollutants —Sulphur gases, Diesel fumes, &c.—will still be about in ever-increasing density. And, of course, Industry, Power Stations and the like have not been prohibited from emitting smoke."

An advertisement by the Bristol Coal Merchants' Association went even further. Under the bold heading:

KILLER SMOGS

Coal Fires Not Guilty say Experts

Real Danger Named

—the advertisement went on by quoting Dr. Horace Joules and Sir Walter Fergusson Hannay that (*a*) sulphur dioxide and (*b*) diesel fumes were really responsible. Reference is also made to the observations reported some years ago at Sheffield that found a correlation between bronchitis and sulphur dioxide but not between bronchitis and smoke. It is hardly necessary to mention that there is no reference to other and more recent investigations.

This particular advertisement reproduces a table of sulphur dioxide emission from different fuels. This, as it stands, shows that coal in the home produces a considerable amount of sulphur, while if it were corrected on a useful heat or efficiency basis it would show that more sulphur dioxide is emitted from an open coal fire than from any other kind of fuel, including diesel and heavy fuel oil. This seems an odd way of defending coal, and if the advertisement were taken seriously its effect would be to drive readers to the virtually sulphur-free fuels—town gas, electricity and paraffin!

Some of the leaflets make an appeal on health grounds. Answering its own question about the burning of kitchen waste the N.W. region leaflet says:

> " Since the burning of kitchen waste (particularly waste oil and fats) on your fire would cause you to emit smoke from your chimney, you will be prevented from doing so and it appears it will again be necessary for you to consign it to the dustbin, thereby encouraging the flypest and aiding and abetting the spread of disease."

Since the Building Research Station has just issued a report on the harm done to the fabric of chimneys by burning kitchen wastes the householder may wonder what is for the best, and may even be driven to disposing some of it (if he has a garden) by composting it, keeping the lid on the dustbin, or even wrapping it up in an old newspaper before consigning it to the dustbin, thereby foiling the " flypest."

Then there is an appeal to the pocket:

> " Costs of Public Health Department expansion and Cleansing Department additional expenditure on refuse collection and disposal will inevitably result in increased Rates, or, alternatively, limitation of other essential services."

No estimate of this possible cost is made, nor is it compared with the savings in chimney-sweeping or the other savings that will accrue to the householder and his family from clean air—£5 to £10 per head per year, according to the Beaver Committee's inquiry into the economics of air pollution.

One of the choicest bits of propaganda recently was a letter from a Mr. Emmett (signed as " Member of the Institute of Fuel ") in the *Oldham Weekly Chronicle*, criticizing a statement that there was no scientific evidence that coke, as distinct from coal, produced fumes which were dangerous and injurious to health. He declares that

> " . . . in coal combustion most of the sulphur gas released is absorbed in the volatiles, and a large quantity of this is condensed on the sides of the domestic flue

> and so never finds its way into the atmosphere. Even when it does the effect of the sulphur fumes is minimized."

He goes on to quote the favourite comment, already mentioned, on the Sheffield observations—from a note in the *Medical World*—about the correlation of sulphur dioxide with bronchitis mortality. As by far the greater part of the sulphur dioxide in the air of Sheffield at that time must have come from the burning of coal he is neatly contradicting his earlier contentions!

Immoral

We exercise immense restraint in writing of this campaign by the coalmen. Less inhibited is John Trafford, commentator of the *Evening Chronicle*, Manchester, who wrote:

" How selfish can you get? The North West region of the Coal Merchants' Federation has been distributing a leaflet. . . . I call it immoral. It is an attempt—for reasons best known to the Federation—to condemn men and women to unnecessary illness and perhaps premature death, to smog, to grey skies, to hours of extra cleaning and of extra scrubbing and painting."

N.I.F.E.S. FIFTH

The fifth annual survey, with report and accounts, of the National Industrial Fuel Efficiency Service, is once again an encouraging account of excellent work done for the promotion of fuel efficiency. It is also an excellent, well-illustrated glossy publication.

One section of the report is about N.I.F.E.S. and the Clean Air Act. A few paragraphs of this may be quoted for their general interest—especially to local authority readers:

" Although fewer boiler operators have come forward for training than was expected, the calls in other directions on N.I.F.E.S. services have increased as the result of the Clean Air Act. During the past year, several hundred firms have asked for advice on smoke and grit problems and examples of the results on boilers and on furnaces have been given earlier in this Survey. Faulty operation of the plant has most frequently been the cause of the nuisance and a short course of instruction for the operators has proved a useful first-aid measure. The installation of mechanical stokers has often proved to be a worth-while investment because of the reduction in fuel costs that results. At other factories the causes have been found to be poor maintenance of the plant, loads on the boilers that are too high or too low, unsuitable equipment and, very occasionally, unsuitable fuel.

" Many of these inquiries from industry have resulted from recommendations made by officers of the local authorities. Several Public Health Inspectors make it a practice to advise owners of plants who are experiencing difficulty to consult N.I.F.E.S. In such instances, the officers of the local authority are naturally anxious to be informed about the progress made. N.I.F.E.S. engineers, however, must make their report to the industrialists employing them, but they do encourage their clients to keep the local authorities informed as there is every advantage in doing this. It is, for example, not always possible for an industrialist to obtain the best results immediately, or time may be required for the delivery of new equipment for training. N.I.F.E.S. experience is that the local authorities are invariably helpful and co-operative as long as they are kept in the picture and are satisfied a real effort is being made."

The Survey also refers to the local authorities who are now employing N.I.F.E.S. to examine applications for prior approval, and to the refresher courses they have arranged for Public Health Inspectors and the assistance given to technical colleges in running similar courses. Several hundred Public Health Inspectors have participated.

The Facts About Domestic Smoke

Need for Greater Emphasis

IT is generally agreed that smoke from the raw coal fire is one of the most harmful and dangerous constituents of the air pollution from which this country suffers, if not the worst of all. There has perhaps been a tendency not to over-stress this because of a fear that in doing so the impression might be created that other forms of pollution were of less importance than in fact they are. Because the attack on air pollution should be conducted all along the line there has not been any concentration on any one sector.

Today, however, we find that the case for industrial smoke prevention has been widely accepted and that although there is still a good way to go this constituent is clearly on the way out. Dust and grit from industry present problems that are being tackled in many ways with steady results. Road vehicle pollution demands, and is at last beginning to receive, closer attention. Sulphur gases are still an intractable problem, but it would be foolish to defer progress elsewhere—as some have seemed to suggest—until this too can be overcome.

There is good reason, therefore, for emphasizing much more strongly the case against domestic smoke, not only because it is so serious, but also because its abolition is likely to require more effort, and perhaps take more time, than anything else among the pollutants among which we know progress can be made. The efforts being made by those defending the raw coal fire, which as reported elsewhere in this issue include propaganda to belittle the importance of domestic smoke, sharpen the need to expose its evil effects much more vigorously, even at some risk of seeming to put other pollutants below it.

If the consequences of domestic smoke are set out and compared with other elements in the general pollution it becomes indisputably clear that it is in fact the most serious form of air pollution as we know it. The following is a summary of the items that lead to this conclusion.

1. Smoke is unburned coal. It consists of carbon or soot (flame smoke) and large numbers of minute particles of tar and hydrocarbons (distillation smoke, mainly from domestic coal fires). The smaller these particles the more harmful they are to the respiratory system, and most of the smaller particles come from the short household chimneys, where there is less chance of coagulation than in taller industrial chimneys. The domestic smoke, produced by distillation at comparatively low temperatures may contain up to twenty times as much tar and hydrocarbons as industrial smoke.

2. The latest investigation, carried out by the British Coal Utilization Research Association and reported in this journal (Summer, 1959, No. 110, p. 273), shows that every 100 lb. of coal burned in an open domestic fire emits into the atmosphere from 2½ to 5 lb. of smoke. From factory furnaces the amount is 8 oz. or less.

3. The total weight of domestic smoke is estimated to be 1 million tons a year. That from industrial sources is now much less than this, and the lowest estimate (B.C.U.R.A.) puts it as low as 100,000 tons, although other authorities put it higher than this.

4. Industrial smoke is evenly spread over the year. That from domestic sources is largely concentrated into the

winter months, and is especially heavy during very cold weather and when the likelihood of fog is highest. Generally, therefore, domestic smoke must predominate during the periods when smoke concentrations are most dangerous.

5. Industrial smoke, usually emitted at a higher level, has a greater chance of rising into the upper air or of being spread thinly by the time its particles reach ground level. Low level domestic smoke frequently eddies down to near ground level and can more readily become concentrated during periods of inversion.

6. The highest bronchitis rates in the world are found in Britain, and the highest of these are in our larger and smokier towns. There are smoky towns abroad, but the raw coal open fire is found only in Britain. Other factors may be involved, but the Beaver Committee found that " there is a clear association between pollution and the incidence of bronchitis and other respiratory disease." This association is of course greatest during the winter months when domestic smoke predominates.

7. The Beaver Report also said that " the comparative death rates for urban and rural areas generally suggest that pollution of the atmosphere may be a factor in the production of cancer of the lung." The probability of this has been strengthened since the report was published, and the substance or substances likely to be responsible are those found among the hydrocarbons chiefly present in domestic smoke.

8. During the winter months the smoke pall cuts off from our towns up to one half, or even two-thirds of the available sunlight and daylight (diffused sunlight), including the important ultra-violet radiation. Many authorities consider this to be at least as serious as any other health aspect of air pollution, and again most of the pall is due to the low-lying domestic smoke.

9. It is the deposits of smoke and grit, from both industry and home, that create the familiar and unpleasant deposits of grime found in every town. It is however the adherent tarry domestic smoke deposit that is the most difficult to remove.

The Question of Sulphur

It is sometimes argued that even if smoke is abolished the sulphur dioxide will remain and that this is perhaps even more harmful. Even if this were true it would be no reason for not pressing on with the abolition of smoke. In any case sulphur dioxide is more harmful when associated with smoke than when emitted alone. It is also more harmful when emitted at low rather than high levels.

The only ways at present available for reducing the emission of this gas, in or for domestic use, are by (*a*) cleaning the original coal, whether it is to be used raw or processed; (*b*) washing the combustion gases, at present only done at two power stations and not practicable on any wide scale; (*c*) using virtually sulphur-free fuels—gas and light oils, including paraffin; (*d*) using electricity, free from emissions in the home, and to generate which the sulphur in the coal used is emitted at a much greater height than from the domestic chimney; (*e*) using solid smokeless fuels in efficient domestic appliances so that, even though they do contain sulphur, the amount is reduced because less fuel is required. With a closed stove, for example, burning coke, the thermal efficiency is thrice that of the old-fashioned coal fire. If the percentage of sulphur is the same in both fuels, and usually it is similar, the amount of sulphur dioxide produced is cut down by two-thirds of that from the coal fire.

The raw coal open fire, in fact, not only creates the worst form of smoke, but because of its thermal inefficiency actually emits, per unit of useful heat, more sulphur dioxide than any other form of fuel.

The raw coal fire stands doubly damned.

The Electricity Council's First Report

Report and Accounts of the Electricity Council, January 1st, 1958 - March 31st, 1959. H.M.S.O. 11s. 6d. net.

UNDER the provisions of the Electricity Act of 1957, the Central Electricity Authority ceased to exist on January 1st, 1958, and two new authorities were established, the Central Electricity Generating Board, responsible for the generation and transmission of electricity for sale to the Area Boards for distribution, and the Electricity Council as a central Authority for consultation on and formulation of a general policy for the Electricity Supply Industry in England and Wales, and for advising the Ministry of Power on matters affecting the industry. The Council is also empowered to perform services for, or act on behalf of the Boards if requested by such Boards to do so. The Council is required to report to the Minister, not only on the performance of its own functions and policy, but also to provide a general review of the progress of the electricity industry as a whole.

The trading and financial results of the industry for the year ending March 31st, 1959, were as follows:

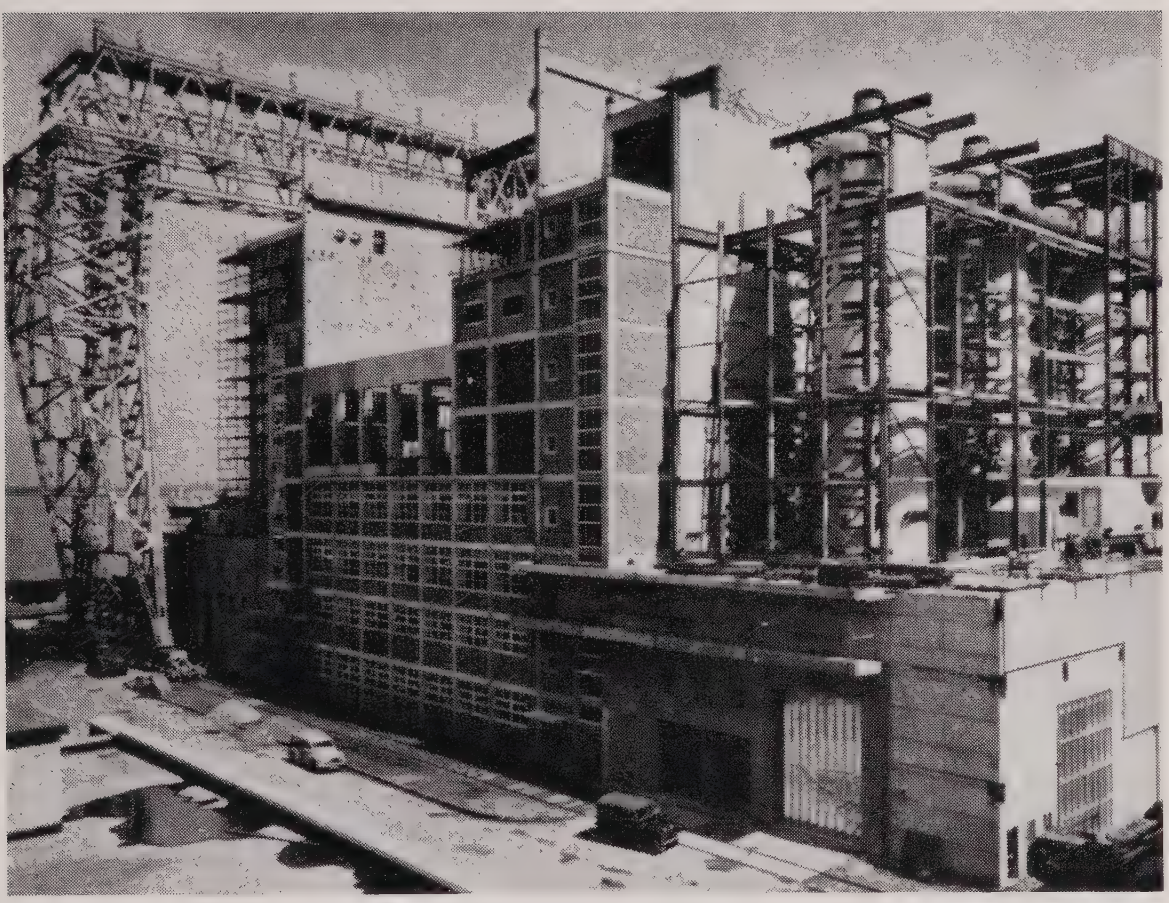
The total number of consumers at the end of the year was 15,182,772 an increase of 2·1 per cent.

79,098 million units of electricity were sold, an increase of 7·5 per cent. The average price of electricity sold to consumers was 1·554d., compared with 1·533d. during the previous year.

The combined revenue was £517·8 million and the combined expenditure on revenue account amounted to £490·4 million, of which the chief items were £235·5 million for generation, £80·5 million for depreciation, and £60·1 million for interest, leaving a consolidated surplus of £27·3 million.

Every effort has been made by the industry to keep down the capital cost of plant and also to achieve the fullest capital use of the plant. The Act of 1957 provides that in all works involving a substantial capital outlay, each Board shall act in accordance with a general programme settled in consultation with the Council and approved by the Minister. By close consultation between the Council and the Boards, a policy is evolved whereby generation, transmission and distribution are kept in balance.

The Electricity Supply industry is heavily capitalized and accordingly it is necessary to keep down capital expenditure—without compromising efficiency—and to ensure the fullest use of its plant and equipment. The Grid permits the reserve of generating plant to be reduced to a minimum. To attain the fullest use of generating plant it is necessary to increase the annual load factor which has risen since 1947-8 from 43 to 47 per cent. Further to increase this factor, attempts are being made to build up night and week-end loads, extend summer uses and to level off most acute peaks. To this end the Council has encouraged the design of apparatus adapted to take current at off-peak periods, such as block storage heaters, floor heating equipment, etc. and the use of such apparatus is encouraged by lower charges for off-peak use. Floor warming load of some 20,000 kilowatts is now in operation in new houses and flats. It is pointed out that a much greater contribution could be made by industry by the extension of shift working, by the operation of processes involving heavy current consumption such as electric furnaces, kilns, pumps in mines and waterworks, processes



Bradwell Nuclear Power Station—No. 1 *Reactor*

in current and chemical works, etc., during off-peak periods.

At the end of the year 212,402 farms, 76·9 per cent of the farms in the country, were connected to the electricity supply system. The average consumption on farms is low, and it would be of great assistance to the electricity industry if more power were used for driving machinery. Consumption of electricity in commercial horticulture, for soil warming, mist propagation, etc., is increasing, forming an advantageous summer load.

The commercial use of electricity during the year amounted to 9,959 million units, an increase of 8·5 per cent, of which 55 per cent was used for lighting, 24 per cent for space heating, 7 per cent for power, 6 per cent for water heating, and 8 per cent for other purposes.

Sales to industrial consumers amounted during the year to 38,259 million units, an increase of 3·7 per cent on 1957-8. The average consumption of electricity per worker amounted to 4,500 units as against a comparable figure of 19,000 units, in the U.S.A.

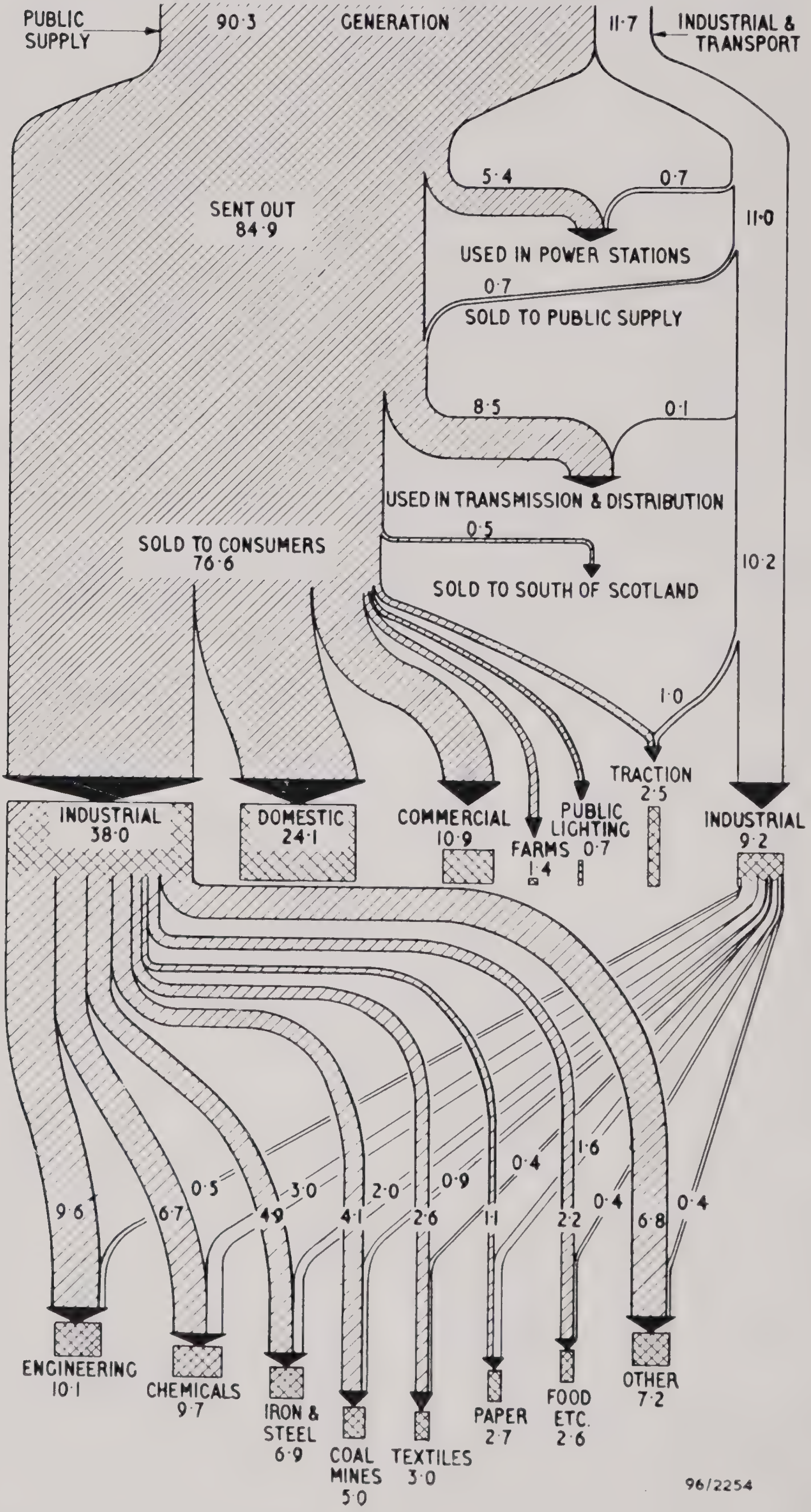
Sales of electricity for road traction have decreased as trams and trolley buses have been replaced by diesel buses. In the near future increasing supplies will be taken for rail traction.

Public lighting authorities took 675 million units, an increase of 7·1 per cent.

The thermal efficiency of generation increased from 25·51 per cent in 1957-8 to 26·10 per cent, due to bringing into commission of plant of higher efficiency, better performance of existing plant and by decreasing use of plant of lower efficiency. The works cost per unit fell from 0·6661d. to 0.6445d. The installed capacity of new plant brought into commission amounted to 1,205,000 kilowatts, the net increase after allowing for revisions of rating and plant shut down was 1,094,000 kilowatts.

SUPPLY AND CONSUMPTION OF ELECTRICITY IN ENGLAND AND WALES.

FIGURES RELATE TO CALENDAR YEAR 1958 AND ARE EXPRESSED IN THOUSAND MILLION KILOWATT HOURS.



The estimated maximum demand under average weather conditions is 30,000,000 kilowatts and to meet this, the Generating Board after consultation with the Council have annual programmes of generating plant amounting in the aggregate to 11,766,000 in 1964. The largest generating set commissioned during the year was one of 120,000 kilowatts at Blyth, working at 1,500 lb. per sq. in. and 1000°F. Larger units of 200,000, 275,000 and 550,000 kilowatts have been ordered.

The Generating Boards' main transmission system consists of 10,360 circuit miles of overhead lines and underground cables, an increase of 940 miles. The total includes 1,717 miles at 275 kv., 8,020 miles at 132 kv. and 623 miles at lower voltages. Progress was made in plans to connect the systems in England and France by submarine cable, transmitting by high-voltage direct current.

Since 1948 supplies to 596,713 consumers on direct current and 743,737 consumers on non-standard alternating current have been converted to standard alternating current supply. 1,804,214 consumers still remain on non-standard supplies.

The Meters (Periods of Certification) Order 1959 in general provides that electricity meters shall be certified at the end of fifteen years of service. Arrangements are in hand for the withdrawal of a representative sample of meters that have been in use, so that they may be examined and tested to ascertain if a longer period of certification is warranted.

Amenities

In the siting of power stations and transmission lines attention is given to the least possible interference with the amenities of the countryside, and consultation takes place with Government departments and public bodies such as the National Parks Commission, Nature Conservancy, the Royal Fine Arts Commission, etc. It is regretted that on account of cost, and also of technical difficulties, it is impossible to utilize underground cables for high tension transmission.

The Electricity Act, 1957, lays on the Electricity Council the duty of settling, in consultation with the Minister, a general programme of research into matters effecting the supply of electricity. The Council may themselves conduct research and may arrange with others, including any of the Boards, for the conduct of research and to periodic economic review. Research on generation and bulk transmission of energy falls naturally within the province of the Central Electricity Generating Board. Distribution research is carried out by a Panel consisting of Council and Area Board Officers, while research into utilization of energy by consumers is carried out by three similar Panels to cover the fields, (i) load and cost research, (ii) apparatus and method research, and (iii) market research.

The diagram shows approximately the supply and consumption of the total output of the Electric Supply System expressed in thousand million units.—*A. J. C.*

G. W. Farquharson

Mr. G. W. Farquharson, a member of the Society's Council for many years, and at present Chairman of its Parliamentary and Local Government Committee, has recently retired after 25 years' service as Chief Smoke Inspector of Birmingham. He is also Hon. Secretary of the Society's successful West Midlands Divisional Council.

On the eve of his retirement he gained the approval of the Health Committee to a plan for the biggest single operation yet considered in the drive to turn Birmingham into a clean air city within the phased fifteen years' programme that has been approved by the City Council. This programme is estimated to cost £1,640,000 and will entail adaptations or conversions to fire grates in 255,184 private dwellings and 48,486 pre-war council houses.

SMOKE CONTROL AREAS

Progress Report

POSITION TO DECEMBER 31st, 1959—TOTALS

	England and Wales	Scotland
Smokeless Zones (Local Acts) in Operation . .	44	1
Acres, 3,400		
Premises, 41,060		
Smoke Control Areas in Operation	108	3
Acres, 13,693		
Premises, 95,730		
Smoke Control Orders—		
Confirmed	86	2
Submitted	117	4
Proposals Notified	249	7
Not Confirmed (*Deduct*)	1	
Grand Totals	603	17

The lists given below are supplementary to the information in the last issue of SMOKELESS AIR (Winter, 1959) which gave the position up to September 30th, 1959. They now show the changes and additions to December 31st, 1959.

Some of the areas listed are new housing estates, or areas to be developed for housing. The total number of premises involved will therefore increase. An asterisk denotes that there have been objections and that an informal inquiry has been or will be held.

ENGLAND AND WALES

New Smoke Control Areas in Operation

Battersea M.B. No. 1, Birmingham C.B. No. 3, Bristol C.B. No. 1, Enfield B. No. 1, Fulham B. No. 2, Halifax C.B. No. 1, Hammersmith M.B. No. 1, Hampstead M.B. No. 2, High Wycombe B. Nos. 6, 7 and 8, Huddersfield C.B. Nos. 1 and 2, Kensington M.B. No. 1, Lambeth M.B. No. 1, Leeds C.B. No. 1, Lewisham M.B. No. 2, Liverpool C.B. No. 7, Paddington M.B. No. 1, Preston C.B. No. 1, Royton U.D. No. 1, St. Marylebone M.B. No. 2, Sheffield C.B. No. 1, Stoke Newington M.B. No. 2, Wallasey C.B. No. 1, Warwick B. No. 1, Wellington (Salop) U.D. No. 1, West Bromwich C.B. Nos. 2, 3 and 4, Westminster M.B. No. 2, Willenhall U.D. Nos. 2, 3, 4 and 5, Woolwich M.B. Nos. 1 and 2.

New Orders Confirmed but not yet in Operation

Aireborough U.D. No. 3, Barnet U.D. No. 1, Barnsley C.B. No. 1, Bermondsey M.B. No. 2, Bradford C.B. No. 1, Brentford and Chiswick B. No. 1, Bury C.B. No. 1, Camberwell M.B. No. 1, *Crawley U.D. No. 1, Deptford M.B. No. 1, Dudley C.B. No. 3, Elstree R.D. No. 1, Felling U.D. No. 1, Greenwich M.B. No. 1, Hayes and Harlington U.D. Nos. 12 and 14, Horsforth U.D. Nos. 1 to 7, Knottingley U.D. Nos. 2 and 3, Leamington Spa B. No. 4, Leeds C.B. No. 3, Leicester C.B. No. 3, Lewisham M.B. Nos. 3 and 5, Liverpool C.B. No. 9, Mansfield B. No. 1, Nuneaton B. No. 1, (Part), Reading C.B. No. 2, Rotherham C.B. No. 5, St. Marylebone M.B. No. 3, Salford C.B. No. 3, S.E. Derbyshire R.D. No. 3, Southgate B. No. 1, Stalybridge B. Nos. 3 and 4, Sunderland C.B. No. 1, *Wallasey C.B. No. 2, Willesden B. No. 2.

New Orders Submitted for Confirmation but not yet Confirmed

Acton B. Nos. 1, 2 and 3, Altrincham B. Nos. 2 and 3, Ashton-under-Lyne B. No. 1, Beddington and Wallington B. No. 1, Bethnal Green M.B. No. 1, Bolton C.B. Nos. 3, 4 and 5, Bredbury and Romiley U.D. No. 1, Bromley B. Nos. 1 and 2, Brownhills U.D. No. 1, Chelsea M.B. No. 1, Denton U.D. Nos. 3 and 4, Dewsbury C.B. No. 1, Ealing B. No. 2, East Barnet U.D. No. 1, Edmonton B. No. 2, Failsworth U.D. No. 1, Friern Barnet U.D. No. 1, Fulham M.B. No. 3, Gateshead B. Nos. 1 and 2, Hackney M.B. No. 2, Halifax C.B. No. 2, Hebburn U.D. No. 1, Heston and Isleworth B. No. 2, Heywood B. No. 1, Holborn M.B. No. 2, Hornsey B. No. 2, Jarrow B. No. 1, Kensington M.B. Nos. 2 and 3, Kingswood U.D. Nos. 1 and 2, Leamington Spa B. Nos. 6, 7 and 8, Lewisham M.B. No. 4, Nottingham C.B. No. 1, Padiham U.D. No. 1, Preston C.B. No. 2, Prestwich B. Nos. 2 and 3, Richmond B. No. 1, Rotherham C.B. Nos. 6 and 7, Sale B. No. 2, Salford C.B. Nos. 2 and 4, Scunthorpe B. No. 1, Smethwick C.B. No. 2, Solihull B. No. 1, Spenborough B. No. 1, Stepney M.B. No. 1, Stoke Newington M.B. No. 4, Wakefield C.B. No. 1, Wandsworth M.B. No. 2, Warrington C.B. Nos. 1 and 2, Wath-upon-Dearne U.D. No. 1, Westminster M.B. No. 3, Widnes B. No. 1, Wilmslow U.D. No. 4, Winsford U.D. No. 1, Wortley R.D. No. 3.

Proposals Notified to the Minister

Acton B. Nos. 4 and 5, Aireborough U.D. Nos. 9 and 10, Aldridge U.D. Nos. 1, 3, 4 and 5, Audenshaw U.D. No. 2, Barnet U.D. No. 2, Barnsley C.B. No. 2, Billingham U.D. No. 1, Birkenhead C.B. No. 1, Bolton C.B. Nos. 6 to 14, Bradford C.B. No. 3, Brierley Hill U.D. No. 11, Brighouse B. No. 2, Camberwell M.B. No. 2, Cheadle and Gatley U.D. No. 1, Chingford B. No. 1, Crawley U.D. No. 2, Dagenham B. No. 2, Droylesden U.D. Nos. 3 to 7, Ealing B. No. 2, Edmonton B. No. 3, Enfield B. No. 2, Hackney M.B. No. 3, Halesowen B. No. 1, Hayes and Harlington U.D. No. 13, Heckmondwike U.D. No. 1, Hemel Hempstead B. Nos. 1 and 2, Heston and Isleworth B. No. 2, High Wycombe B. No. 9, Holborn M.B. No. 3, Horsforth U.D. Nos. 8 to 14, Huyton-with-Roby U.D. No. 1, Ilford B. No. 1, Lewisham M.B. Nos. 6 and 7, Lincoln C.B. No. 1, Liverpool C.B. No. 10, Middleton B. Nos. 3 to 6, Mirfield U.D. No. 1, Morley B. Nos. 1 to 7, Prestwich B. No. 4, Ramsbottom U.D. No. 1, Reading C.B. Nos. 3, 4 and 5, Rochdale C.B. Nos. 3 to 7, Royton U.D. No. 2, St. Pancras M.B. No. 2, Salford C.B. No. 5, Sedgeley U.D. No. 2, Stockport C.B. No. 2, Stoke-on-Trent C.B. Nos. 5 and 6, Sunderland C.B. Nos. 2, 3 and 4, Wallasey C.B. 4, 5 and 6, Wednesbury B. No. 1, West Bromwich C.B. No. 10, Westminster M.B. Nos. 4 and 5, Wetherby R.D. No. 1, Willenhall U.D. Nos. 8 and 9. Wolverhampton C.B. No. 1, Woolwich M.B. Nos. 7 and 8, Worsley U.D. No. 2.

SCOTLAND

New Smoke Control Areas in Operation

Dundee B. No. 1, Glasgow C.B. No. 1.

New Orders Confirmed but not yet in Operation

Coatbridge B. No. 1.

Proposals Notified to the Minister

Clydebank B. No. 1.

A.P. in Poland

Experts investigating air pollution in Upper Silesia—Poland's major industrial area—have promised to reduce the dirt in the atmosphere by 50 per cent. in two years.—*Reuter.*

Control of Smoke and Dust Emission from existing Coal Equipment*

by

Harold J. Rose

Bituminous Coal Research, Inc., Pittsburgh

AS the national research association for bituminous coal, Bituminous Coal Research, Inc., has been active in research, development, and the issuing of engineering publications in the interests of clean air.

A separate paper summarizes some of BCR's accomplishments in developing clean, automatic coal-burning equipment for commercial, small industrial, and residential markets. The present summary will deal with other BCR activities relating to the objectives of the Conference.

Smoke Prevention

The major approach to controlling smoke emission from fuel beds has been the proper application of secondary air over the fuel bed to prevent smoke and soot formation at the source. A very extensive programme of engineering research, plus experience with many field installations, resulted in a technical bulletin (Ref. 1) which has received wide acceptance in the United States as the standard engineering reference on the subject. Various city clean-air ordinances require that overfire-jet installations must conform with the recommendations of this BCR manual.

The information is organized for easy use so that an engineer can quickly and confidently specify the design, construction, and installation of overfire jets to fit any particular situation. Full information is given for blower jets, steam-air jets (Fig. 1), plain steam jets, and their operation. The designs are not patented.

Overfire Jets for Stationary Plants. Many thousands of BCR-design overfire jet installations are in successful use in the United States and Canada in plants of very diverse types and sizes. The installations vary from the simplest types, which are turned on manually as needed after intermittent hand fuelling, to automatic types actuated by timers or photoelectric controls.

Overfire Jets for Steamboats. Modern overfire jets on steamboat boilers have proved their value as smoke-abatement devices to accompany proper firing practices (Ref. 2).

Steam Locomotives. Several thousand steam locomotives were equipped with steam jets for smoke abatement, particularly for switching service. However, steam locomotives have now been largely replaced by diesel-electric locomotives in the United States. Therefore, Bituminous Coal Research, Inc., has studied two additional approaches to powering locomotives by coal burned smokelessly.

Coal-Burning Gas Turbines. One approach has been the coal-burning gas-turbine locomotive, in which pulverized coal is burned under pressure in a completely smokeless manner. Suspended fly ash is removed by a special fly ash separator developed for the purpose (Fig. 2), which is presently about 92 per cent efficient. Several tests of more than 1,000 hours duration each, on a full-size 4,200 horsepower gas turbine test installation, have shown that the coal handling, pulverization, combustion and fly ash

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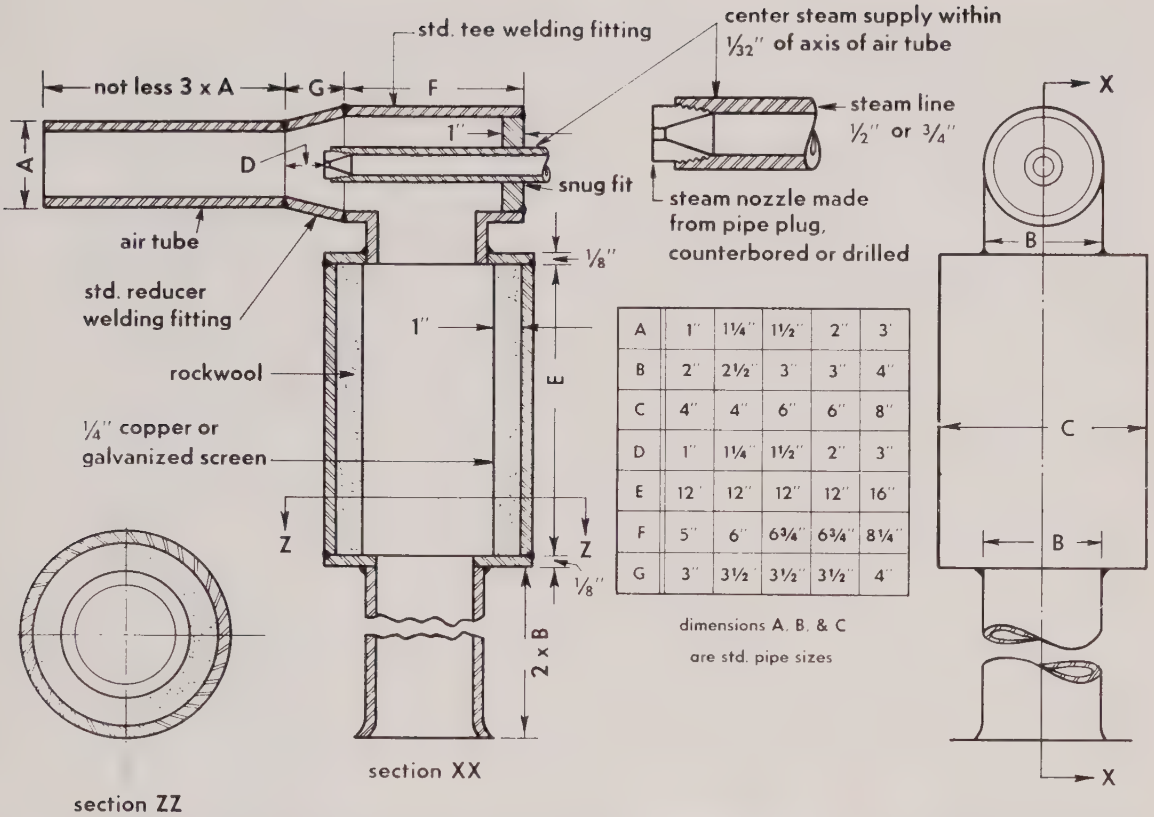
* Manuscript prepared for Diamond Jubilee International Clean Air Conference, but received too late for inclusion in the Proceedings.


std. tee welding fitting
center steam supply within 1/32" of axis of air tube
not less 3 x A
G
F
A
D
1"
snug fit
steam line 1/2" or 3/4"
steam nozzle made from pipe plug, counterbored or drilled
X
B
air tube
std. reducer welding fitting
1/8"
rockwool
1"
E
C
1/4" copper or galvanized screen
Z
Z
1/8"
B
2 x B
section XX
X
section ZZ

A	1"	1¼"	1½"	2"	3'
B	2"	2½"	3"	3"	4"
C	4"	4"	6"	6"	8"
D	1"	1¼"	1½"	2"	3"
E	12'	12"	12"	12"	16"
F	5"	6"	6¾"	6¾"	8¼"
G	3"	3½'	3½"	3½"	4"

dimensions A, B, & C are std. pipe sizes

Fig. 1. *Typical design of BCR steam-air jet with suspended silencer, for smoke prevention*

removal units perform very satisfactorily. It is now up to railroads and commercial builders to construct the first locomotives using coal-burning gas turbines.

BCR's 4,200 horsepower gas turbine and auxiliaries have been loaned to the U.S. Bureau of Mines, which plans to conduct additional development work in co-operation with industry on further refinement of turbine blade design, improvement of materials of construction, and the attainment of even higher dust-collection efficiencies in order to extend the life of the gas-turbine blades. The Bureau is interested primarily in stationary plant application, (*a*) to increase the overall efficiency of steam-cycle power generating plants and (*b*) to provide power generating facilities for vast arid regions of the West which have large coal reserves, but inadequate water supply for condensing steam turbines.

Railroad Electrification. Another approach has been the preliminary investigation of the possibilities for expanding railroad electrification in the United States, using power from coal-burning central stations of electric utilities. The results of a preliminary study completed in 1952 indicated that the possibilities were sufficiently encouraging to warrant further study.

Preventing Dust Emission

Small Stationary Plants. BCR research findings and field experience in preventing dust emission from fuel beds, and during soot blowing, have been summarized for convenient use (Ref. 3, 4).

Spreader-Stoker Firing. Spreader stokers offer many advantages for stationary industrial boilers of intermediate size, but it is well known that suspension-burning devices present major dust emission problems. Since little factual information was available on the amount and practical methods for reducing such dust carry-over, BCR organized a joint research programme with spreader-stoker manufacturers, the results of which have been published (Ref. 5, 6). The dust collected from spreader-stoker combustion gases contains a rather high percentage of combustible, and plant tests have been made on re-injecting the dust to reclaim fuel values and to reduce the amount of dust requiring disposal (Ref. 7, 8).

Large Power Plants. BCR has actively assisted in developing commercial markets for the fly ash recovered from the combustion gases of pulverized-coal-fired power plants. (Ref. 9, 10). In co-operation with the Association of Edison Illuminating Companies and the Edison Electric Institute, BCR is conducting two research projects on improved methods for reducing the sulphur content of coal, and reducing sulphur oxides in stack gas.

Dustless Handling of Coal and Ashes. Pioneer research was done on the treatment of coal with oil and with solutions of deliquescent chemicals, to allay dust (and for freeze-proofing coal shipments in severe winter weather) (Ref. 11). At present about 60 million tons of coal are treated each year at U.S. mines to allay dust in transportation, handling and use.

A separate paper refers to developments in combustion equipment which feed coal from the bin and remove ashes in closed systems which minimize dust emission on the premises. A BCR publication has been issued which illustrates in more detail some possibilities for clean coal-and-ash handling with conventional equipment (Ref. 12).

Research on the coal-burning gas turbine referred to above, resulted in many patented inventions, and the perfecting of techniques for handling coal and ash in closed systems.

Coal Combustion Conferences. It is not enough to conduct the necessary scientific and engineering research, and to prepare and distribute clearly-written publications on how to use research results for solving practical problems. Experience has shown that personal contacts are necessary to engender interest and confidence in new equipment and new techniques.

As a result, BCR found it necessary to organize conferences in principal cities of the United States and Canada where coal is the major fuel, to discuss practical methods of smoke and dust prevention, and the use of new automatic coal-burning equipment. Many thousands have attended these conferences.

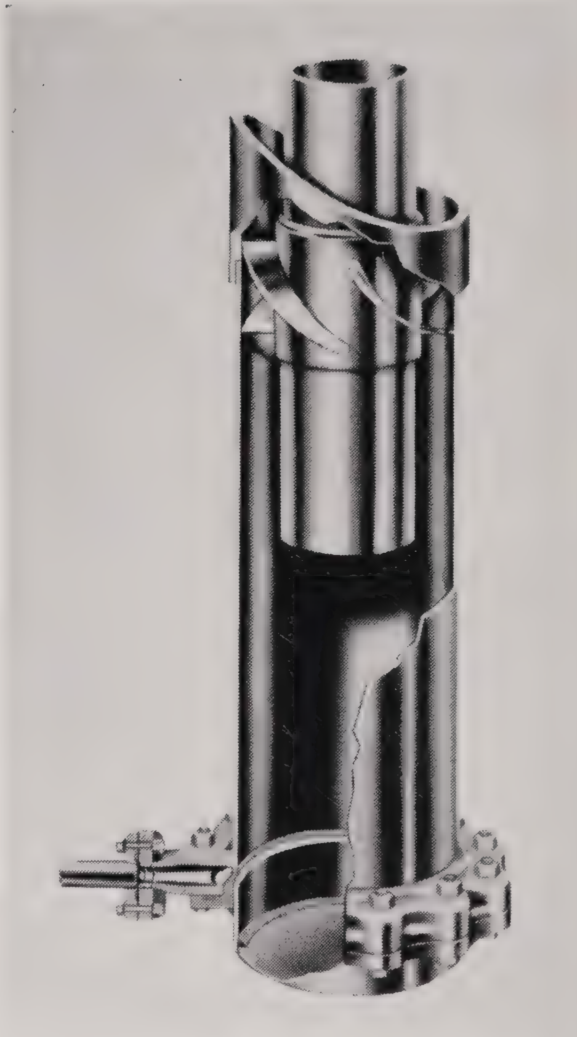


Fig. 2. Dunlab Mark III separator developed by the Locomotive Development Programme of BCR for the removal of fly ash from hot pressurized gases

This summary mentions only part of the activities and only a few of the scores of technical publications by Bituminous Coal Research, Inc., which relate to clean air.

Conclusion

Research, engineering development, and technical promotion of the resulting information have been productive and successful. The results obtained have in general been proportional to the amount of effort expended.

REFERENCES

1 " Application of Overfire Jets to Prevent Smoke from Stationary

Plants." BCR Aid to Industry 500-300, (Revised Sept. 1957). 50c.

2 "Application of Overfire Air to Steamboats" by W. S. Major, Proc. Smoke Prevention Assoc. of Amer., 31-38 (1947); also "Application of Overfire Jets to Steamboats" (illustrated) by W. S. Major, Waterways, Oct. 1947. Reprint available from BCR—no charge.

3 "How to Reduce Stack Dust from Small Stationary Plants." BCR Aid to Industry 500-320 (1952). 40c.

4 "Stack Sprays to Reduce Dust Emission During Soot Blowing." BCR Aid to Industry 500-330 (1957). 10c.

5 "Methods of Reducing Dust Emission From a Spreader-Stoker-Fired Boiler Furnace" by W. C. Holton and R. B. Engdahl. A.S.M.E. Paper No. 51-SA-20 (1951). Reprint available from BCR. 20c.

6 "Dust Emissions from Small Spreader-Stoker-Fired Boilers" by E. J. Boer and C. W. Porterfield (1953). 25c.

7 "Investigation of Gravity Reinjection of Fly Ash on a Spreader-Stoker-Fired Boiler Unit" by C. H. Morrow, W. C. Holton, and H. L. Wagner, Trans. Amer. Soc. Mech. Eng., pp. 1363-1372, Oct. 1953.

8 "A Study of Spreader-Stoker Reinjection Systems" by W. C. Holton, A.S.M.E. Paper 54-A-117 (1954).

9 "Fly Ash for Use as a Construction Material." BCR Aid to Industry 600-910 (1956). $1.00.

10 "Fly Ash Utilization in the U.S.A." by H. J. Rose and H. H. Russell. Paper prepared for annual meeting of Vereinigung der Grosskesselbesitzer, Karlsruhe, Germany (June 1959).

11 "Treatment of Coal Surfaces" by R. A. Sherman and J. M. Pilcher, Chapter 21 of "Coal Preparation," pp. 739-772 (1950), Amer. Inst. Min. Met. Engrs.

12 "Coal and Ash Storage and Handling For Plants Using up to 5,000 Tons of Coal Annually." BCR Aid to Industry 500-810 (1956). 35c.

FUEL RESEARCH REPORT

New Data on Smoke Distribution

Fuel Research, 1958. Department of Scientific and Industrial Research. H.M.S.O., 2s. 6d. net.

This, the last report of the Fuel Research Board of the D.S.I.R., was received as we went to press. A full review must be deferred, but reference must be made to the section on the measurement of atmospheric pollution. From the 303 smoke filters in operation at the end of 1958 new information about the level of the suspended smoke in the atmosphere is noted:

"In a few places in rural areas or on the coast, the average smoke concentration does not exceed 2-3 milligrammes per 100 cubic metres, whereas at the other end of the scale, in a few industrial towns, it amounts to about 60mg/100 cu. m. In the vast majority of towns, ranging in size from 5,000 to a million inhabitants, the concentration is anything between 10 and 30 mg/100 cu. m. Only 27 instruments gave concentrations over 30 and only 12 over 40 mg/100 cu. m. The lack of dependence of smoke under normal conditions on size of town, although at first sight surprising, is in accord with the view that the removal of smoke in an upward direction by atmospheric turbulence is a more important factor in its dispersal than a sideways drift near ground level."

The report reproduces the diagram published in the paper by Pindard and Wilkins at the N.S.C.A. Llandudno Conference, 1958, showing the reduction in smoke in the smokeless zone of the City of London—40 per cent.—and comments that "it would thus appear that, under normal conditions local benefit is obtained by control of smoke emission in a zone which is surrounded by areas in which close control is not at present feasible." It is pointed out that the benefit may be diminished or even lost under conditions of persistent temperature inversion.

AIR POLLUTION BY SULPHUR DIOXIDE, HYDROGEN SULPHIDE AND CARBON DISULPHIDE

Ladislav Rosival and Milan Strecha

(Institute of Hygiene of the Medical Faculty of Komensky University in Bratislava, Director Academician V. Mucha)

(*A contribution received for the International Clean Air Conference, but too late for inclusion in the Proceedings*)

WITH the growing industrialization of our country air pollution also increases. The fight against it is not only one of the chief problems in projecting new towns and industrial enterprises, but also a problem in reconstructing old towns and residences.

In our study we referred to the pollution of the atmosphere by some detrimental effects of homogenous phases of gases *i.e.*, sulphur dioxide, hydrogen sulphide and carbon disulphide.

Sulphur dioxide was examined polarographically according to Roubal, hydrogen sulphide and carbon disulphide colorimetrically.

The town of Bratislava is bordered on the north west by the small Carpathians, on the north east by a group of large chemical works with very differential chemical technology, and on the south by the river Danube. Annually 30,000 tons of SO_2 are eliminated into the air of Bratislava.

Observing the air pollution with SO_2 in the winter season at nine observing stations we found in the result of 84 experiments after eight hours that the highest concentrations appeared at the main railway station (0·706 mg/m^3) and in the residential part in the centre of the town (0·623 mg/m^3), the cause of which is the dense inhabitation of these places. In comparison with these, the concentrations of SO_2 are much lower (0·0254 and 0·0299 mg/m^3) in the suburban districts, which ensues partly from the fact that the only larger source of contamination with SO_2, the manufacture of sulphuric acid, is situated at a distance of about 2 km from residential quarters, and that there are comparatively fewer buildings, and it is not possible to separate any influence of micro- or macrometeorological factors.

Judging the macrometeorological conditions in Bratislava during the past year, it is observed that a north wind arose in 19 per cent, a north west wind in 19 per cent, a north east in 14 per cent; the windless period amounts to 17 per cent and other directions of the wind to 31 per cent. The greatest speed marked, 10 km/h, was reached by the north west wind, by the north wind 6·5 km/h. The stated information was kindly given to us by the Meteorological Institute of the Faculty of Science of Komensky University in Bratislava.

Table No. 1 below contains the concentrations of SO_2 in the atmosphere of Bratislava during various annual periods after examinations of 217 samples.

It will be seen that SO_2 daily attains 0·0314 mg/m^3 in the cold period and in 24 hour samples it rises to 0·0382 mg/m^3 which may be mainly attributed to the sudden sinking of temperature in the early morning. The estimations are six times higher than those cited by Spurny in Prague.

The appearance of SO_2 concentrations according to Babajancs classes of cleanliness, shown in Table No. 2, indicate that somewhat more than 50 per cent of samples belong to the first two classes of clean or slightly

Period	*Average conc. SO_2 in mg/m³ during the day (7–15 h.)*	*Class of cleanliness*	*Number of samples*	*Average conc. SO_2 in mg/m³ during 24 h. (7–7 h.)*	*Class of cleanliness*	*Number of samples*
Spring (21.III–21.VI)	0·0177	II	30	0·0112	II	3
Summer (21.VI–23.IX)	0·0042	I	5	—	—	1
Autumn (23.IX–21.XII)	0·0154	II	63	0·0388	IV	11
Winter (21.XII–21.III)	0·0314	IV	84	0·0382	IV	20
Heating (from 15.X)	0·0283	III	136	0·0336	IV	34
No heating (from 15.IV)	0·0070	I	46	—	—	1
Annual	0·0228	III	182	0·0335	IV	35

Table 1

Concentration of Sulphur Dioxide in the air of Bratislava in different annual periods

Group (mg/m³ SO_2)	*Class of air cleanliness with classification after Babajanec*	*Number of samples through the day*	*%*	*Number of 24 h. samples*	*%*
0·00 –0·011	I. Clean	64	35·16	10	28·57
0·011–0·02	II. Slightly polluted	35	19·23	10	28·57
0·02 –0·03	III. Moderately polluted	30	16·48	4	11·43
0·03 –0·04	IV. Perceptibly polluted	13	7·14	3	8·57
0·04 –0·08	V. Heavily polluted	36	19·78	4	11·43
Over 0·08	VI. Very heavily polluted	4	2·21	4	11·43
		182	100·00	35	100·00

Table 2

Quantity of concentrations of Sulphur Dioxide in the air of Bratislava according to classes of cleanliness of the air

polluted air, while the rest of the 24 hours samples are equally divided into the remaining four classes of cleanliness. The USSR recommended as the maximal permissible concentration of SO_2 0·15 mg/m³, as the average estimation and 0·50 mg/m³ as for once.

Examining the correlations between temperature and concentrations of SO_2 during a year at one of the observing stations, it is noticeable that there exists an indirect correlation between temperature and concentration of SO_2 (Diagram 2). It is evident that the vertical gradient of temperature, as shown in Diagram 1, is, apart from the speed of the wind, the most important factor influencing the intensity of the diffusion of noxious chemicals in the air. Periodical appearances of the gradient of temperature together with various quan-

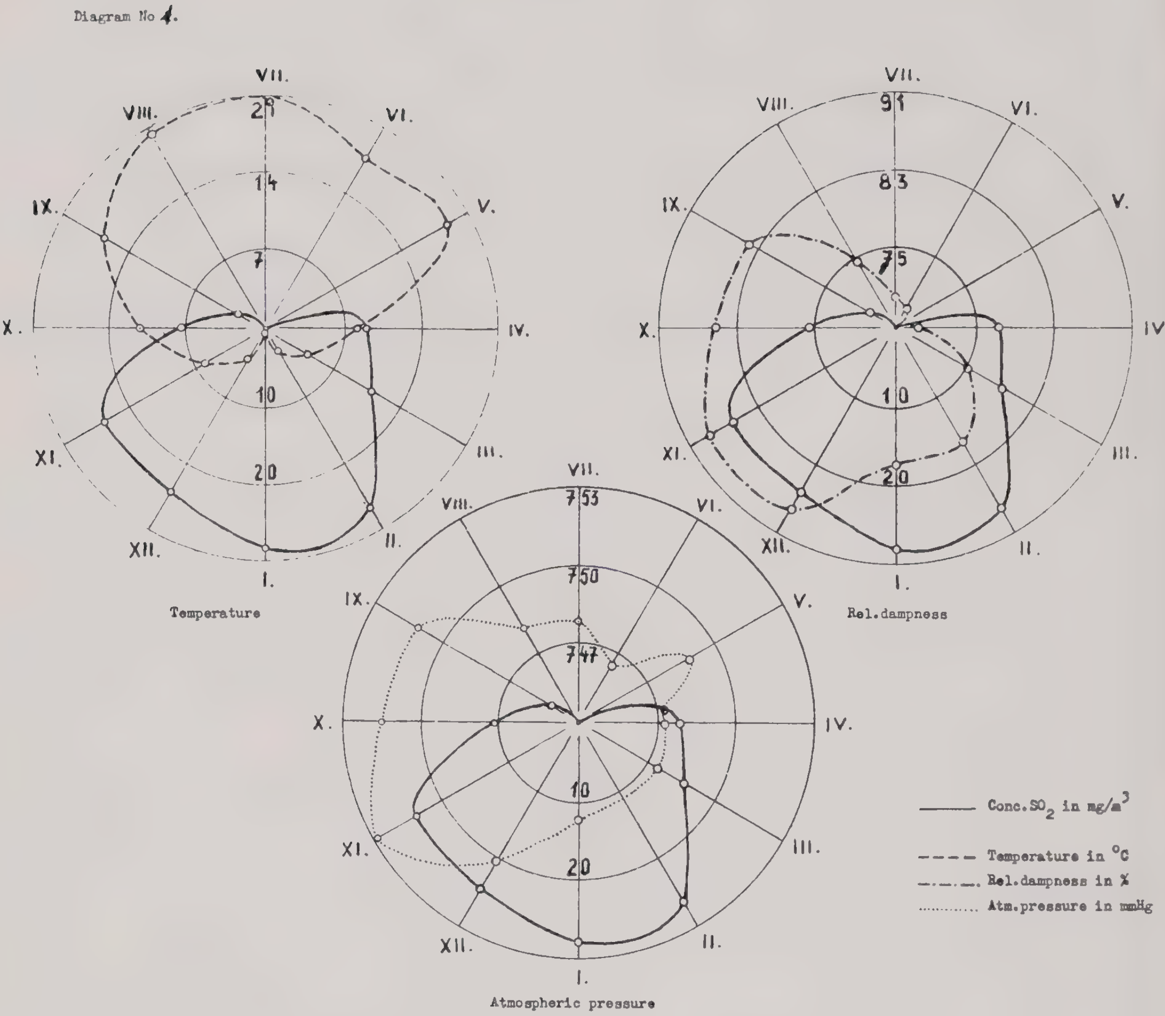


Diagram No. 1

tities of burned coal are the chief reasons for appearance of SO_2 concentrations. Abolishing harmful chemicals through vertical streams which cohere with the vertical distribution of temperature, is more useful than the horizontal stream. Vertical streaming enables their disappearance from lower regions where their presence is more seriously felt. While horizontal streaming gets larger in the height and proves truer especially in higher parts.

Dampness is also very important for the distribution of SO_2 with increase of which the concentration of SO_2 rises too. Its effect though is not so characteristic as the effect of temperature (Diagram 2).

Diagram 2 describes the correlations between temperature, dampness, atmospheric pressure and concentrations of SO_2.

The closest correlation with the coefficient of correlation $r = -0{\cdot}892$ appeared with temperature, a somewhat lower $r = +0{\cdot}863$ with relative dampness, while correlation with atmospheric pressure was not proved ($r = 0{\cdot}001$).

Pollution at Chemical Works

Beside the examinations of sulphur dioxide in vital surroundings, we have made a survey of its appearance in the atmosphere of 3 large chemical works in Slovakia.

It was shown that the maximal permissible Czechoslovak concentration in the air, 0·25 mg/l, which is 10,000 times higher than our established annual concentration of SO_2 in vital

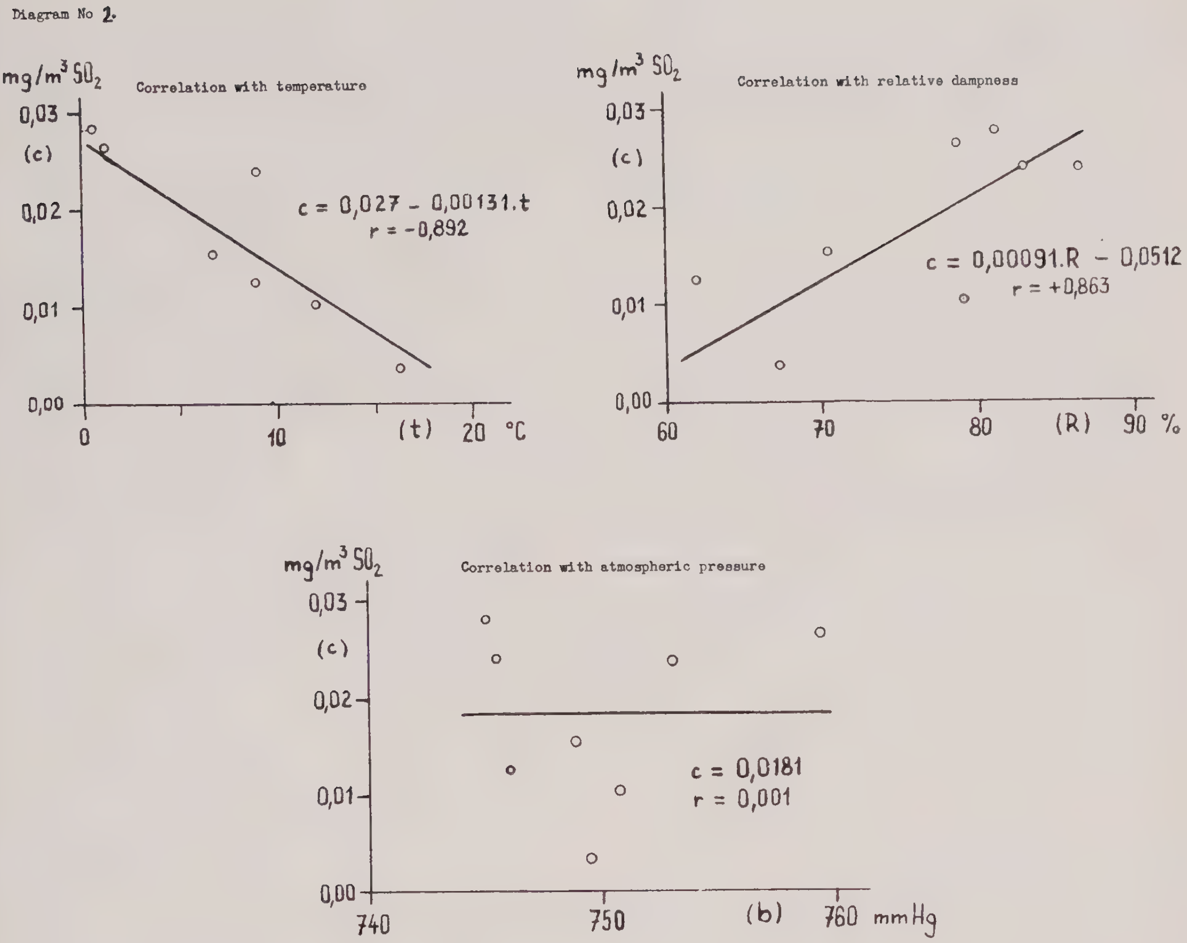


Diagram No. 2

space, is many times transgressed. This is connected with the fact that the responsible factories are out of date and overburdened; with very few hygienic-technical measures, such as: automatization, hermetization and ventilation. Nevertheless we found no case of chronic poisoning by sulphur dioxide in the chemical industry of Slovakia.

When we compare the statements about concentrations in vital surroundings, it is found that the concentrations of SO_2 caused by industrial conditions are of no consequence in vital surroundings. Yet it is to be considered that it does not only mean a continual exposure of middle aged people of good health, as those employed in industrial works, but also of an exposure of children and older people and people whose health is disturbed by various diseases. In the vital sphere there are usually present more materials with a possible synergistic effect, whose physical qualities can change through hard or liquid aerosols and thus enable a greater penetration into the lungs to be made. Finally, it is evident from our hitherto existing notes that chronic diseases of the lungs, or cardiovascular maladies, which are not often to be met with in workers, tend to increase with irritating materials in vital surroundings.

Hydrogen Sulphide

Beside SO_2 we turned our attention to H_2S, collaborating with the Hygienic-Epidemical Station in Bratislava who examined the contents of H_2S in 243 samples of air from a large chemical factory manufacturing viscose thread.

From Table No. 3 we can see the appearance of graduated concentra-

Distance from the source	*to* 250 *m.*		*to* 500 *m.*		*to* 1,000 *m.*		*to* 1,500 *m.*	
Concentration H_2S in mg/m^3	*Number*	%	*Number*	%	*Number*	%	*Number*	%
0·000	11	13·0	22	22·2	2	7·2	0	0·0
0·001–0·015	15	17·6	21	21·1	3	10·7	6	19·4
0·015–0·040	23	27·0	13	13·1	9	32·1	12	38·7
0·040–0·080	12	14·0	18	18·2	7	25·0	8	25·8
0·080–0·100	5	6·0	8	8·1	1	3·6	1	3·2
0·100–0·500	17	20·0	16	16·2	6	21·4	3	9·7
0·500–1·0C0	2	2·4	1	1·1	0	0·0	1	3·2
Summary of examinations	85	100·0	99	100·0	28	100·0	31	100·0

Table 3

Air Pollution by Hydrogen Sulphide

	Place obtained	*Number of examinations*	*Concentration CS_2 in $\mu g/1$*
Spinning room	Hall	14	53·1 ±13·4
	At the cord machines after withdrawal	21	117·9 ±33·8
	At the cord machines during action	9	84·7 ±27·7
Sulphidation	Upper part of hall	6	29·2 ±10·7
	Lower part of hall	7	41·1 ±14·0
	Average in the hall	13	35·6 ±13·1

Table 4

Carbon Disulphide in the Sphere of Action in a Factory for Viscose Thread

tions at different distances from the source. It is evident from the table that the concentration of H_2S, as shown by the given percentages, is many times greater than the highest once admissible concentration 0·030 mg/m^3, which was commended by Loganova in U.S.S.R. and is lower than perception by smell, 0·040 mg/m^3. From an inquiry among 100 inhabitants living near the factory, it is evident that higher concentrations of H_2S appear especially in the morning at irregular time intervals for some hours. They unfavourably affect the subjective state of health of people, disturbingly influence their sleep, prevent ventilation of dwellings and thus lower the hygienic standards and vital comfort of the inhabitants.

We met the highest stages of acute effects of H_2S at spinners of viscose thread, where the concentration of H_2S rises in some hazardous situations, showing symptoms of irritation or even inflammation of conjunctiva, pains, a feeling of sand and burning in the eyes, shunning the light and running of tears. These symptoms disappear after one to three days. The question of chronic poisoning in this manufacturing process remains open, because so far there is no direct proof that a chronic exposure to H_2S in such work has caused a higher amount of symptoms relating the nervous system in comparison to workers not exposed.

Carbon Disulphide

From sporadic references in the literature about the effect of carbon disulphide on people in vital surroundings it is noticeable that there is not even indirect evidence about its unfavourable influence on the health of people. So far the effect of chronic toxic poisoning by carbon disulphide is to be judged mainly from accounts of occupational exposures.

In our studies we gave attention to the grade of exposure against CS_2 during the manufacture of viscose thread by following this noxious material in the air and its presence in the urine. There is a survey in Table No. 4 showing the appearance of CS_2 during sulphidation and in the spinning room of viscose thread. In consequence of these notes we see that the emissions during sulphidation do not exceed the maximal permissible concentration. Contrary to that, the average concentrations in the spinning room are twice as high as the norm. While following the separation of CS_2 in the urine of spinners in collaboration with the Clinic for Occupational Diseases in Bratislava we came to the conclusion that one-third of 119 samples did not contain any carbon disulphide at the beginning of the work shift, while its concentration in the remainder seldom exceeded 20 μg/l urine. After their working time, the concentrations became fundamentally higher, but we marked only in 2 cases 90 μg/l in urine. Those were workers who after a rest of 8 hours continued their work. According to Teisinger the separated quantity of carbon disulphide in the urine averages only about 0·06 per cent with considerable inter-individual differences. We were able to state that, while finding some micrograms of CS_2 in the urine, the hygienic conditions of the works are good. Discovering only a few millgrams of CS_2 in the urine is a sign of unsatisfactory hygienic circumstances.

From hitherto existing records it is clear, that for an objective estimation of the grade and character of air pollution, it is most necessary to use a large number of simple instruments and analytical methods to establish the individual harmful agents. The aim of these studies demands a national and international standardization of apparatus and analytical methods to gain reliable and comparable results. At the same time it is necessary in international measures to simplify the terminology in morbid cases, where an influence due to air pollution is suspected, because different terms and classifications by various countries in studies about air pollution renders collaboration and correct interpretation of results more difficult.

This endeavour to unify methodological recording in the question of air pollution must be looked at as part of the complex of varying and different hygienic-toxicological problems of the present time. Besides pollution of the air in vital and working spheres by noxious materials, the pollution of water, soil, plants and food through chemicals and radioactive radiation, forms a mutual interest for theoretical proofs of the maximal permissible concentrations of noxious chemicals and for the practical settlement of this problem in a preventive and sanative sense.

Twickenham a Black Area ?

A meeting of the Twickenham Council was told by the Town Clerk on December 3rd that the Ministry of Housing and Local Government was not sure whether the area was in the Greater London black area or not. The Ministry's map showing " black areas " was on too small a scale and it was impossible to say whether it was inside the area or not. He had written to the Ministry but all they could say was that their provisional view was that it was and that a report should therefore be submitted.

CLEAN AIR FOR HONG KONG

Hong Kong, with a dense population of some three millions, and with an increasing number of crowded small industries, plus an airport that can be very seriously affected by the city smoke, has adopted a new and vigorous Clean Air Ordinance (No. 19 of 1959).

Although in many of its definitions and terms the ordinance has close links with our own Clean Air Act, the methods of control are different and in many ways would seem more severe. Thus section 4 begins:

" On any occasion when, in the opinion of a competent authority, a smoke nuisance exists or is imminent, the competent authority shall either personally or through a smoke abatement officer, as soon as practicable after he has become aware therefore, notify, either verbally or in writing, the existence or imminence, as the case may be, of the nuisance to the occupier of any premises in which any furnace, oven, chimney or industrial plant is, in his opinion, by the emission of smoke, causing or contributing to the existence or imminence of such nuisance."

Subject to specified defences failure to comply with this makes the offender liable to a fine of 10,000 dollars if the notification contains a declaration that it is given to preserve the safety of aircraft. In other cases the fine is 2,000 dollars, and in either case there can be a further fine of 50 dollars for every 15 minutes during which the nuisance is continued.

Any area may be declared a smoke control area or a scheduled area. In a smoke control area smoke from any premises must not exceed Ringelmann No. 1, except for a limit of six minutes in four hours or three minutes continuous dark smoke of Ringelmann No. 2. Defences are specified and are the same as those in section 1 of the British Clean Air Act.

Other sections relate to the appointment of officers as " competent authorities," obligation to give information, powers of entry and inspection, and the issue of codes and advice. There is also an important section (14) giving powers to require the modification or replacement or repair, etc., of furnaces, ovens and chimneys of industrial plant, with a penalty of 5,000 dollars, and also prohibiting in any furnace of any fuel or fuels that may be specified.

There are also powers for regulations to prescribe other requirements, including prior approval of new plant and " the employment of competent persons to be in charge of the operation of any furnace or oven or any class thereof."

SMOKE CONTROL AREA PROCEDURE

Speaking at the A.G.M. of the London and Home Counties Clean Air Advisory Council on January 22nd, Mr. Harrop of the Ministry of Housing and Local Government said that the submission of provisional details on proposed smoke control areas to the Ministry entailed much more work than was anticipated originally. He said that there would now be little exception on the part of the Ministry to more approximate information. This part of the procedure took about six weeks to clear and it was interesting to note that no provisional proposals had been turned down in the London area.

He then went on to say that although the second stage in the procedure—the detailed house-to-house survey—had been criticized by some local authorities, its abolition might impede progress in the long run. The main stumbling block between the Ministry and Local Authorities was that of agreement over costs. On the one hand the Ministry required to be satisfied that the local authority was about to proceed correctly, while on the other hand the local authority was entitled to some assurance that the Ministry would meet the commitments involved. The number of claims for grants seemed in almost all cases to be lower than was estimated. This was due to the use of portable heaters. On the subject of conversions which warranted the full grant, Mr. Harrop said that where gas or electric cookers were available, the renewal of combination stoves was not justified. Nor was the expenditure justified in the case of bedroom fireplaces unless there was substantial evidence of use. The tendency should also be to convert fire grates wherever possible, rather than effect a more expensive renewal. He ended by reminding his listeners that grants could not be claimed for houses built after the passing of the Act.

CAMPAIGN IN SHEFFIELD

We are pleased to be able to report on an intensive campaign for clean air, with an exhibition, held in Sheffield in December last, in conjunction with the coming into effect of the city's first smoke control area order. Not only was the campaign carried out in a most comprehensive way, but a very useful detailed report has been prepared and issued by the Health Education Service, a new organization instituted by the city in July, 1959. Local authorities planning clean air campaigns would find this report extremely useful and requests for copies may be made to the Health Education Centre, Moorhead Chambers, Sheffield 1.

The report deals with the background to the campaign, the initial steps in planning it, including the holding of a Press Conference, and describes the co-operation sought for and given by other Corporation departments—the City Treasury, the Libraries, Education Committee and Public Health Department—and by voluntary and national organizations. The publicity activities undertaken are described and a full account of the Exhibition is given. This was inaugurated with a civic luncheon and was opened by Dr. Edith Summerskill, M.P.

An evaluation of the fruits of the campaign was attempted by means of questionnaires given to the public in various localities and at the exhibition. The general attitude to conversion of household appliances had been one of apathy or mild hostility, but as the campaign proceeded there was a distinct change in favour of conversions. Seventy-five per cent. of the questions asked at the exhibition showed that people wanted to know when their own area could become a smokeless zone. There has also been a very sharp rise in the sale of approved appliances and smokeless fuels since the campaign.

Party Support for Clean Air

The Council of the Liberal Party Organization recently passed the following resolution:

" The Council of the Liberal Party expresses its great concern at the lack of progress towards the eradication of the English Disease—bronchitis.

" As steps towards the suppression of this disease the Council propose:

" (i) That the Clean Air Act be made fully effective by 1970, in particular by making obligatory the provision of smoke control zones to cover all urban areas.

" (ii) That the anti-tuberculosis organization, which has largely achieved its aims, be converted into the spearhead of a national anti-bronchitis campaign."

The Conservative Political Centre has published an attractively produced pamphlet entitled " Wage War on Smog " (pp. 40, price 9d.). This describes the problem, outlines the Clean Air Act, has a chapter on smokeless fuels, and another on " Complex Pollutants and other Problems." Altogether a most useful and informative publication.

Clean Air Bill for Budapest

Health authorities in Budapest have been instructed to prepare a bill to control air pollution in the city.

Film Strips on Clean Air

Camera Talks, of 22 Denmark Place, London, W.C.2, the well-known producers of film strips, have just published two film strips on clean air. For this they have had the collaboration of the Association of Public Health Inspectors. The first strip deals with the Role of Industry and the second with Smoke Control Areas. The strips are in colour throughout and with each strip there is a booklet of descriptive notes. With a competent lecturer each strip therefore provides material for a full and practical lecture, that on industrial pollution surveying the general problem and illustrating plant and appliances for preventing both smoke and grit. That on smoke control areas would be very suitable for talks both to the general public and to members and officers of local authorities.

The strips, with their accompanying notes, may be obtained either direct from the producers or from the N.S.C.A. The price of each is £2 12s. 6d. They are not available on hire.

House of Commons

Diesel Engine Fumes

Mr. Gresham Cooke asked the Secretary of State for the Home Department if he is satisfied that the police are given sufficient power under existing law to prosecute in cases of obnoxious and excessive diesel engine fumes; and if he will make a statement.

The Joint Under-Secretary of State for the Home Department (Mr. David Renton): The existing powers are regarded by the police as reasonably satisfactory, though difficulties sometimes arise. Careful consideration is being given to my hon. Friend's suggestion for amending the appropriate Regulation which was contained in the Question which he put to my right hon. Friend the Minister of Transport on November 4th.

Mr. Gresham Cooke: Would my hon. and learned Friend think of this point, that the law is really too narrow at the moment to provide a ground for successful prosecutions? In my view, and in the view of policemen to whom I have talked, it would be a help if the words " annoyance or inconvenience " were added to the construction of this Regulation in considering such fumes.

Mr. Renton: I will bear in mind my hon. Friend's view, but I have consulted the Commissioner of Police recently and he has expressed the view that, generally speaking, it is not that there is any short-coming in the wording of the Regulation which prevents prosecution, but that the evidence forthcoming has been inadequate. (*Jan. 28th, 1959.*)

Smokeless Homes as Exhibits

The Scunthorpe Borough Council recently opened four new council houses as exhibition houses in the centre of the first proposed smoke control area.

The houses were furnished in a normal manner by four local furnishing companies. Each house displayed a different smokeless fuel, *i.e.* electricity, gas, coke, and special smokeless fuels. The appliances were demonstrated by the Yorkshire Electricity Board, the East Midlands Gas Board, and the Coal Utilization Council.

The idea of the exhibition was to show how any ordinary council house could be kept warm by the smokeless fuels and how conversions to electricity and gas could be made if required. The houses were open for two weeks and were visited by 10,000 people. This is an excellent figure, as the population of Scunthorpe is just over 60,000.

The local press gave great publicity to the effort and at an informal gathering of all who took part in the exhibition thanks were accorded by the Chairman of the Health Committee, Alderman H. Spencer.

AIR POLLUTION BY SMOKE AND SULPHUR DIOXIDE IN LONDON DURING FOGGY PERIODS, NOVEMBER 1959 TO JANUARY 1960

During this period there were four fogs of any importance. Measurements of air pollution were made by the Warren Spring Laboratory during the first two episodes in East Greenwich and during the second two near St. Giles' Circus. Figures 1 to 4 show the observed levels of pollution for each foggy period. The graphs are all on the same scale and the units used, microgrammes per cubic metre, are the same for both smoke and sulphur dioxide. To convert to milligrammes per 100 cubic metres divide by 10. To convert sulphur dioxide concentrations to parts per hundred million, divide by 28·6.

1. November 11th-13th, 1959

Fog developed on the evening of the 11th. By 9 p.m. visibility, which had been over 3,000 yards at 6 p.m. was down to 300 yards and the wind had dropped. The fog persisted till between 9 p.m. and midnight on the 12th, and was at its worst at about 6 p.m. on that day when visibility was 200 yards. By midnight only mist remained, visibility was 1,540 yards and there was a 7-knot wind. Rain and wind during the night completely dispersed the fog. Temperatures during this episode were between 33 and 43°F.

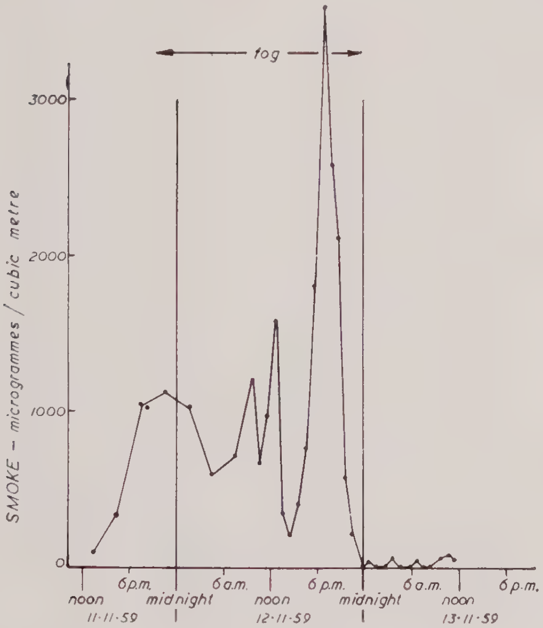


Fig.1 Smoke concentrations at Warren Spring Laboratory, Greenwich for the period 11th to 13th November 1959

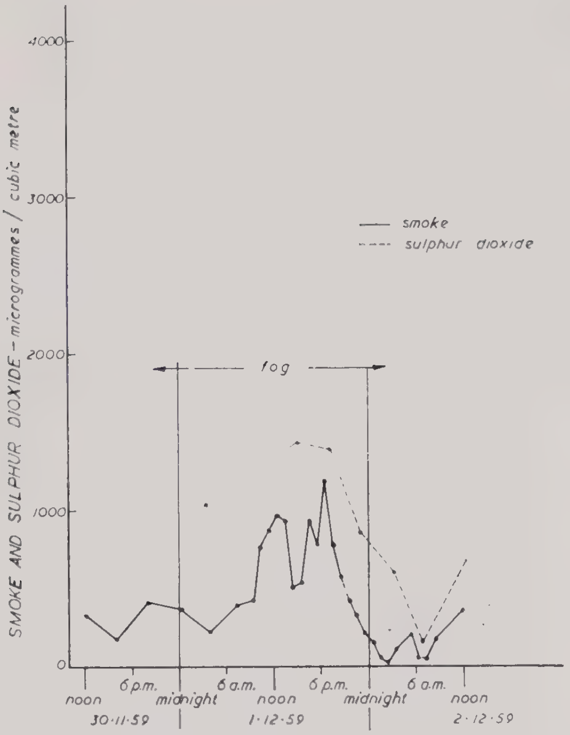
Figure 1 shows how smoke concentration rose to a peak of about 3,600 microgrammes per cubic metre at the height of the fog and rapidly fell to normal levels.

Daily mean smoke and sulphur dioxide concentrations for the 24 hours ending at 3 p.m. on the 12th rose to about four times average winter concentrations at the East Greenwich site.

2. November 30th to December 2nd, 1959

Fog developed late in the evening of the 30th, when the wind dropped, and it persisted till the morning of December 2nd, dispersed by wind with some rain. The fog was at its worst on the morning of the 1st, when visibility was 25 yards at 6 a.m. and at 9 a.m., and on the morning of the 2nd when visibility was 23 yards at 3 a.m., 30 yards at 6 a.m. By 9 a.m. visibility was up to 1,100 yards. On December 1st the fog changed from a wet to a dry fog during the day. Temperatures during this period were between 36 and 44°F.

Figure 2 shows pollution on these days. On this occasion there seems less correlation between visibility and pollution. Pollution was not very high, maximum hourly mean smoke concentration was about 1,200, maximum mean four-hourly sulphur dioxide concentration about 1,400 microgrammes per cubic metre. Daily mean concentrations rose to about 2½ times average winter levels.



NB Sulphur dioxide measurements were made less frequently than smoke measurements, hence the smoother curve for sulphur dioxide.

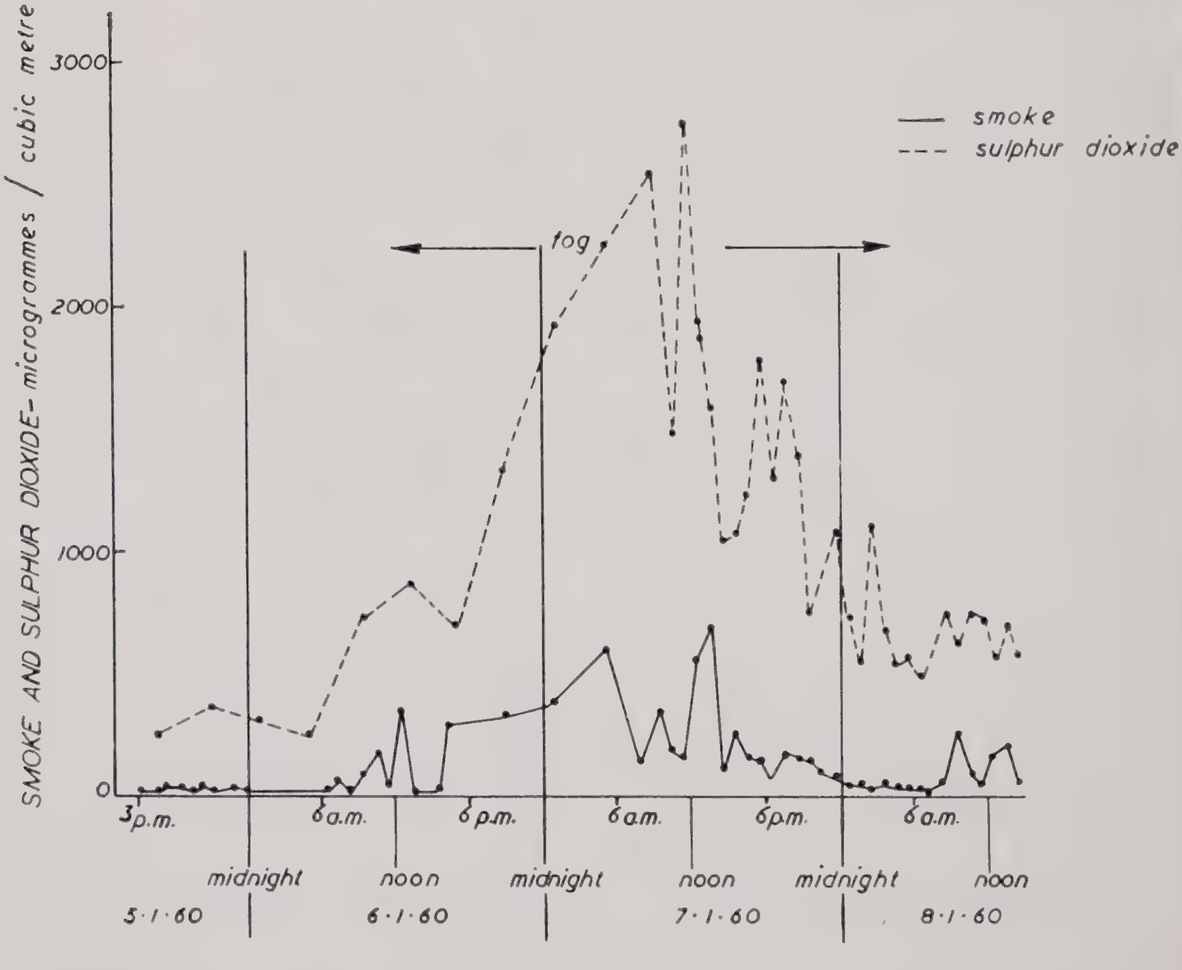
Fig. 2 Smoke and sulphur dioxide concentrations at Warren Spring Laboratory, Greenwich for the period 30th November to 2nd December 1959

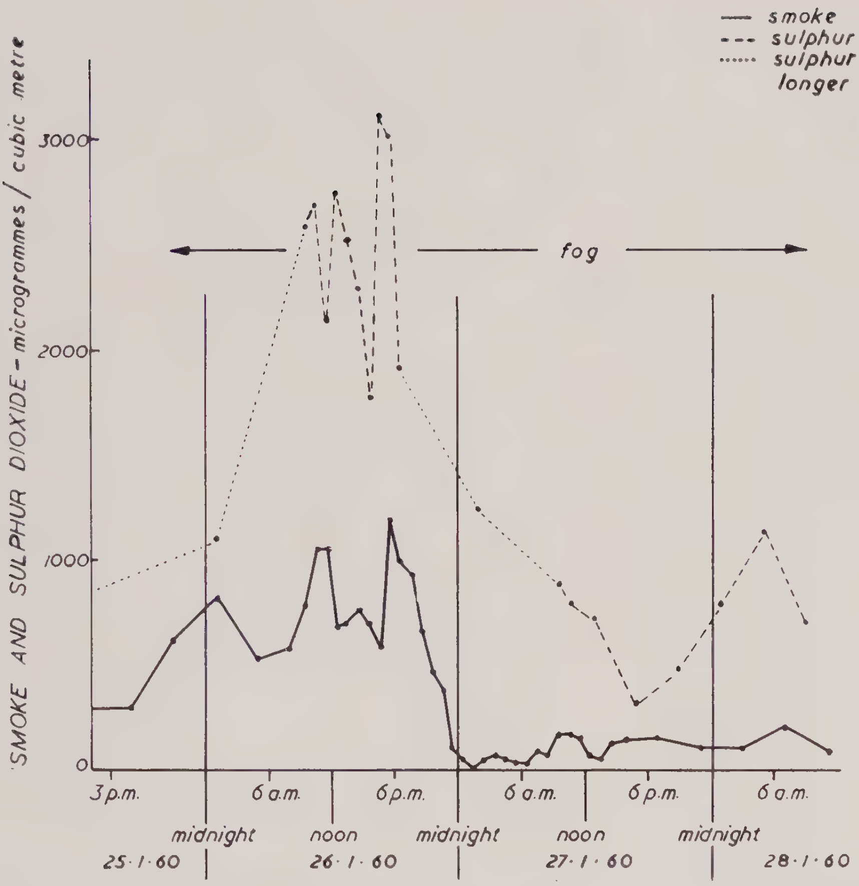
3. January 6th to 8th, 1960

A period of calm at noon on the 6th brought some fog, which was dispersed by south-west wind in the afternoon. By 6 p.m. the wind had again dropped; at 9 p.m. visibility was 600 yards, at midnight it was 20 yards, the worst during this episode. The fog persisted till the morning of the 8th, after which there was mist but no fog. Temperatures were between 34 and 43°F.

Smoke concentrations were relatively low, but sulphur dioxide concentrations were high, as can be seen in figure 3. Maximum hourly mean concentrations were 678 and 2,700, daily mean concentrations rose to a maximum of 513 and 1,086 microgrammes per cubic metre for smoke and sulphur dioxide respectively. There is apparently quite good correlation between smoke concentrations and visibility during this episode.

Fig. 3. Smoke and sulphur dioxide concentrations near St. Giles's Circus for the period January 5th to 8th, 1960





Smoke and sulphur dioxide concentrations near St. Giles's Circus for the period January 25th to 28th, 1960

4. January 25th to 28th, 1960

Fog appeared by 9 p.m. on the 25th. The air had been calm and there had been mist since before 9 a.m. Fog persisted till midnight on the 26th with visibility of about 200 yards during the day after which there was mist and calm till about noon the next day. From about this time till midnight there were easterly or north-easterly winds of up to 16 knots. There was rain late in the evening. Fog in the early hours of the morning of the 28th, when there was no wind, had disappeared by 9 a.m. when it was followed by wind and drizzle. Temperatures were between 38 and 45°F.

Maximum hourly mean concentrations rose to 1,194 and 3,102 and daily mean to 495 and 1,494 microgrammes per cubic metre for smoke and sulphur dioxide respectively. There was apparently fairly good correlation between pollution by smoke and visibility.

The work described in this note forms part of the programme of the Warren Spring Laboratory of the Department of Scientific and Industrial Research and is published by permission of the Director of the Warren Spring Laboratory. The figures are Crown copyright and are published by permission of the Controller, H.M. Stationery Office. The assistance of the Meteorological Office in providing the observations on the weather conditions is gratefully acknowledged.

Warren Spring Laboratory,
Gunnels Wood Road,
Stevenage, Herts.

Another 100,000 tons of Rexco

The National Carbonizing Company's new plant for producing smokeless fuel from top-quality non-coking coal came into operation at Thorsby Colliery, near Mansfield, on December 10th, 1959. Built by Newton Chambers Ltd. in ten months at a cost of £250,000, it will produce another 100,000 tons of Rexco annually.

Mechanical Stokers and the Clean Air Act*

A Paper by

E. W. Barnes, M.Inst.F., A.M.Inst.B.E.

I HAVE been asked to open this discussion on the recent Smoke Control Areas (Exempted Fireplaces) Order and to start off I would like to make it clear that I am fully in agreement with it. Some may feel that as a stoker manufacturer I am a little biased and this quite naturally is true, but this does not mean to say that stoker makers are any less enthusiastic about the Clean Air Act than others; in fact the reverse could be the case, and most of us have been preaching smokeless combustion as an essential ingredient in efficient combustion long before the advent of the Beaver Report or the Clean Air Act. I do feel, however, that there have been some misconceptions about the Act, at least in regard to smoke emission, and this new Order should clear the air in more senses than one.

In the first place I think we should consider what Parliament had in mind when framing the Act—and in saying this I do not profess to be a lawyer in any sense—but it is written in fairly simple language which most of us can understand. It is headed—" An Act to make provision for abating the pollution of the air." The essential word I suggest is " abating," which means minimizing, and while all of us would like the word to be " abolishing " I feel that Parliament knew quite well that this Utopia could not be realized in a comparatively short period if we are to maintain our industries and compete successfully in the markets abroad. We can, however, go a long way in abating the pollution and quite rightly Section 1 of the Act lays down that it is an offence to emit dark smoke from any chimney for periods longer than those specified by the Minister of Housing and Local Government. Dark smoke is defined to be as dark or darker than shade 2 on the Ringelmann Chart and most Combustion Engineers would not consider this to be an unreasonable target.

Section 3 of the Act states that no furnace shall be installed in a building, or in any boiler or industrial plant attached to a building, unless it is so far as practicable capable of being operated continuously without emitting smoke when burning fuel of a type for which the furnace was designed. Notice to install such a furnace must be given to the local authority in every instance and if in addition the plans and specifications are submitted to, and approved by, the authority, the furnace shall be deemed to comply with the provisions of this section. This section does not apply to furnaces and boilers used for domestic purposes with a heating capacity up to 55,000 B.T.Us/hr., so it will not include the normal open fire.

You will notice that in either of these Sections there is no reference to classes of fuel and this, I feel, leads to one of the misconceptions to which I have referred, because some people seem to interpret these sections to mean that bituminous coal cannot be used, as it is a high volatile fuel prone to produce smoke when not burned correctly. I came across a case only recently where a County Council proposed to install a small underfeed stoker, but the local Rural District Council for the area where the plant was situated refused to approve the scheme, not on the grounds that the stoker could not operate without smoke, but because it would use bituminous coal and approval would make it difficult for them to take action if there was some smoke emission when the machine was installed.

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* The opening contribution at a joint meeting of the N.S.C.A. and its S.E. Division in London on 11th December, 1959. A report of the discussion follows.

This decision was taken under Section 3 of the Act which as I have mentioned stipulates that new furnaces shall be as far as practicable *capable* of being operated without smoke emission. If the furnace is installed in accordance with plans approved by the local authority it shall be deemed to comply with this requirement and the point here is that approval means only that the furnace is considered capable of working smokelessly and it is still encumbent on the owner to ensure that in fact it is *operated* without smoke emission. If it is not the local authority can take action.

Prior Approval

I have referred to these two Sections as they set down quite plainly what is the intention of the Act in regard to smoke emission from furnaces and as they apply to the country as a whole I consider them most important. It is not compulsory to submit plans for approval, but where this is done—and many of those intending to install a new furnace will think it is the right thing to do—it places a heavy responsibility on the shoulders of local officials, who may be new to this work. I have been in combustion engineering most of my life but I do not pretend to know the answers to all the problems which arise and I would expect it to present some difficulty to a Health Inspector, who I assume is trained primarily on entirely different matters, to decide whether the design of a combustion scheme is good or bad. There are, of course, exceptions to the rule and I know that some local authorities are employing men having an excellent knowledge of combustion, but in general I would not think this is the case.

To avoid discrepancies throughout the country, the obvious thing would seem to be for the Ministry to issue a list of appliances designed to burn bituminous coal which are approved as being acceptable under the Act, but although they could call on the advice of the Ministry of Power and various scientific institutions they have not done this and the decisions have been left to Local Authorities which do not, in most cases, have such technical advice at their disposal.

In making this Order, therefore, I consider that the Minister has done the next best thing by giving a clear lead to those who have to administer the Act and it is for this reason that I welcome the Order. It does, of course, refer only to Section 11 of the Act and it gives exemption to mechanical stokers from the provisions of that section. It does not refer to Sections 1 and 3 and has no need to do so, as they do not contain any restrictions as to the type of fuel, only that it should be burned without undue smoke emission, but what is permissible for Smoke Control Areas is obviously satisfactory for the remainder of the country.

Smoke Control Areas

I would like to refer now to Section 11 of the Act, under which local authorities can establish Smoke Control Areas. As I see it this Section does not nullify any of the other provisions of the Act but it does go a stage further by ruling that there shall be no smoke from any building in a declared Smoke Control Area. It does not allow dark smoke for even the short periods specified by the Minister of Housing under Section 1, and it goes further by stating that only authorized fuels shall be used. But here again Parliament must have realized that this ideal would be difficult to achieve, as the local authority may limit the operation of this section to specified classes of buildings in the area and may exempt other specified buildings or fireplaces, while the Minister may by order exempt any class of fireplace from the provisions of this section if he is satisfied that it can be used for burning fuel other than the authorised fuels without producing smoke, or a substantial quantity of smoke.

The authorized fuels are coke, anthracite, low volatile steam coals, manufactured smokeless fuels, gas and electricity. In 1957 the Minister issued another order exempting from the provisions of Section 11 fireplaces designed or adapted for the combustion of liquid fuel, provided they are so installed, maintained and operated as to minimize the emission of smoke. This does not make oil an authorized fuel, so if dark smoke is emitted for periods longer than those specified the user will be liable to prosecution. The new order which we are discussing today gives exemption to fireplaces which, after the end of December 1956, are equipped with mechanical stokers. The conditions about installation, maintenance and operation are the same as for oil firing, but there is an extra condition that no fuel shall be used other than that for which the mechanical stoker was designed, and this generally means bituminous coal. As in the case of oil this does not make bituminous coal an authorized fuel but it does allow its use in a mechanical stoker in a Smoke Control Area.

With this new exemption one may be tempted to think that no very useful purpose will be served in creating Smoke Control Areas, but this view would be entirely wrong. It would be based on the mistaken impression that bituminous coal cannot be burned smokelessly on mechanical stokers or that oil fuel cannot be burned smokelessly with well designed oil burners. I suggest that the main purpose of a Smoke Control Area is to dispense with domestic smoke, which is smoke from private dwellings, offices and other non-industrial buildings. We are told that this accounts for half, or more, of all the smoke in the atmosphere.

I think we should look at this in a practical way. Large water tube boiler plants as used in power stations and the big industrial works must be fired mechanically, because it would be impossible to fire them by hand. This is accepted practice and for coal fired plants the fuel is invariably bituminous coal. They are operated by skilled engineers and in view of the vast tonnage of fuel consumed it is essential that the boilers work at the highest efficiency, without smoke, so as to keep down operating costs. At the other end of the scale we have the open grates which are standard in practically all private dwellings and are still common in office blocks and other non-industrial buildings. These domestic fires, in the very large majority of cases, are in the hands of people with no knowledge of combustion principles and with no time to put them into practice, in fact these fires are mostly looked after by housewives and their children. The only way to ensure that smoke is not emitted from these chimneys is to use smokeless fuels and that is why only these fuels are authorized for use in a Smoke Control Area. In saying this I do not think that bituminous coal should be ruled out entirely—at least for the future—as research organizations are working to produce domestic grates which will burn this coal smokelessly and some appliances may already comply with this condition.

Between these two extremes, however, there are large numbers of boilers used for central heating and hot water services, or steam processes, and various types of industrial furnaces, all of which are of a size suitable for firing by mechanical means. It is the mechanical stokers required for these which have now received exemption from the provisions of Section 11 of the Act. In many cases these plants will not have such a high degree of skilled attention as is necessary with the larger boiler plants, but the mechanical stokers are designed with this in view and most of them are in the charge of men who are trained to operate them efficiently.

Fuel Availability

While still looking at this matter from the practical point of view, it should be remembered that coal mining is one of our basic industries on which the economy of the country is based. Last year 215 million tons of coal were produced and although I do not have precise figures I would assume that at least 90 per cent of this is bituminous coal. Large quantities do, of course, go to the electric generating industry for use on the power station boilers I have mentioned, and to gas works for processing into gas and coke, but there still remains a huge quantity used by general industry and for domestic purposes. At this stage, and I venture to suggest for many years to come, the supply of natural and manufactured smokeless fuels is nowhere near sufficient to replace the bituminous coal being fired in its raw state and in any case there would be problems in burning the smokeless fuels on mechanical stokers in the types of boilers which are commonly used. The Minister had this in mind when sending out a Memorandum on Smoke Control Areas and I quote from one paragraph in this document which reads—" Industrial smoke can, on the other hand, be reduced substantially by efficient methods of combustion. Other provisions of the Act, in particular Sections 1 and 3, are designed to secure this: but to prohibit smoke entirely from industrial furnaces fired by bituminous coal would necessitate a change of fuel. To attempt this on any large scale would make impossible demands upon the supply of smokeless fuels, quite apart from the effects upon industry. The available smokeless fuels will be needed, and can be used to better advantage, for the prevention of domestic smoke."

Emission Standards

I noticed an article in the Autumn issue of *Smokeless Air*, on the exemption of mechanical stokers under this new Order and it expresses the concern of many that the blanket nature of this exemption could lead to the installation of stokers of the less efficient type —which would be permitted to produce smoke far greater than would be the minimum with a better machine. In other words does the condition of the order that the stoker should be operated as to minimize the emission of smoke mean that each stoker will be accepted on its merits or will there be a general yardstick for smoke emission which will apply to all machines? I think the Public Health Inspector for the area will make his own estimation of what should be the maximum and in my opinion this would be smoke as dark or darker than shade 2 on the Ringelmann chart, as laid down in Section 1. I cannot see that because a stoker is exempt from the provisions of Section 11 of the Act it will be allowed to emit smoke darker than that permitted in Section 1 and I feel that the wording of the order ties up with that in Section 3 which states that any new furnace shall be as far as practicable capable of being operated without emitting smoke.

At this stage it might be interesting to show a Ringelmann chart in case some present are not familiar with it. It has to be fixed in a position as nearly as possible in line with the top of the chimney and the distance of the chart from the observer should be about 50 ft., so that each square appears of uniform shade.

The writer of the article agrees that mechanical stokers can be operated without smoke, or with so little that it does not matter, and this, of course, is the opinion of all good stoker manufacturers, but I will be the first to admit that there are a lot of stokers in operation which do produce objectionable smoke. This generally is because they are either old machines which have outlasted their useful life, are badly maintained and operated, incorrectly installed, or are using fuel for which they were not designed. There is no doubt that mechanical stokers have not had the best of treatment since the war in regard to fuel, because due to shortage of supplies they have had to put up with whatever fuel was made available for them, irrespective of quality.

During the last two or three years, however, the situation has gradually changed and recently the National Coal Board announced publicly that each user would in future get the type of coal he required. This, I would suggest, introduces a new aspect because the exemption of mechanical stokers applies only to those installed after December 31st, 1956, which means they are up-to-date in design, the right sort of coal will be available and manufacturers will have to ensure that they are properly installed in particular regard to smoke emission. The older and less efficient stokers are not automatically exempt and if they do not comply with the Act they will need to be replaced, subject to temporary exemptions outlined in Section 2. In this connection there is at least one local authority which requests a certificate from the manufacturer stating that after inspection he is satisfied the stoker has been properly installed and can be operated efficiently and without dark smoke when burning suitable bituminous coal. This is an idea which could be extended, because the stoker maker does not always install the machine.

Type of Stoker

So far I have not dealt with the types of stokers available and perhaps this is not the occasion to go into design details, but very briefly there are four main types, known as the underfeed, chain grate, coking and sprinkler. The underfeed stoker feeds the coal from below the fire, and it is certainly smokeless when in operation and using the correct coal. It is the machine used mostly for sectional and vertical boilers, also for horizontal shell boilers and industrial furnaces. The chain grate stoker is used extensively in large water tube boilers but a smaller version was developed some years ago to burn low grade small coal in horizontal shell boilers with considerable success and with this machine it is virtually impossible to make smoke unless it is badly abused. The coking stoker is also used mainly for horizontal shell boilers and this also can operate without smoke when using suitable coal. The sprinkler type of stoker is more akin to hand firing in that it sprinkles coal on top of an incandescent fire and as such is more liable to make smoke, but by using a special grate with secondary air admission it can no doubt be operated without smoke darker than Ringelmann 2.

In dealing with the installation of stokers for horizontal shell boilers there is not much that can be done with the setting because the furnace is a water-cooled tube within the boiler and it is therefore a matter for co-operation between the boiler maker and the stoker maker to ensure that the furnace is of the right size for the duty required. This does not, however, apply to the same extent to sectional, vertical and water tube boilers, as the boiler can generally be raised if necessary to provide sufficient combustion space and the setting is most important in regard to smokeless combustion, efficiency and maintenance. The disposition of water-cooled surfaces and the flame travel have to be taken into account when determining the size of the combustion chamber and this is why emphasis is laid on the correct installation of the machine. A stoker which will operate smokelessly in one setting can produce quite a lot of smoke in another unsuitable setting. With all types of boilers the provision of adequate draught is essential and dampers should be fitted so that the draught can be regulated.

I have said that the underfeed stoker is certainly smokeless when in operation, but this type of machine is invariably fitted with automatic control and when this takes the simple form of stopping the stoker on rise of temperature and restarting on a fall of temperature, there can be some emission of smoke during the idle period. This can, however, be overcome by having automatic control of the modulating type which allows the machine to run continuously and achieves temperature control by varying the feed of coal and the supply of air according to the load. Most underfeed stokers can be fitted with this form of control and there is another alternative which allows the supply of secondary air from a separate fan during the idling periods. Automatic control of the other types of stokers is perhaps not quite so common, but various systems are available which allow them to operate without smoke.

I would like to end this talk, Mr. Chairman, as I started by saying that I am fully in agreement with this new order, which I consider is necessary for the effective working of the Act. I have endeavoured to show that there are adequate safeguards to ensure that mechanical stokers will and must comply with the Act and if in doing so I have given any impression that mechanical stokers cannot be operated entirely without smoke it has only been done to draw attention to the fact that smoke emission when burning bituminous coal can, in any case, be controlled well within the prescribed limits. I thank you for this opportunity to state my views and I shall be very interested to hear during the discussion whether or not they are shared by the members present.

DISCUSSION ON MECHANICAL STOKERS AND THE CLEAN AIR ACT

The foregoing paper by Mr. Barnes opened the meeting held at the Caxton Hall, London, on December 11th, 1959.

The first speaker in the discussion that followed was Mr. N. Bastable, Chief Public Health Inspector, Barking, who drew the attention of the meeting to the objections of the Association of Municipal Corporations to the order exempting mechanical stokers. These objections were:

1. That the effect was to give general exemption to the emission of smoke from mechanical stokers since it did not have to be eliminated but only minimized.
2. That a distinction was thereby drawn between householders in smoke control areas who were prohibited entirely from making smoke and industrialists who could install mechanical stokers and thereby make at least some smoke.
3. Following from the last point local authorities would have powers of enforcement against the householder but not against the industrialist.

Mr. Bastable was followed by Mr. Hayward of Edwin Danks Ltd., who said that his firm made oil burners as well as mechanical stokers. He pointed out that manufacturers must use heat in some form either for power or process heating and that coal was our main national asset. More smoke could be made with oil than with coal if it was abused. He said that there were some discrepancies in the prior approval decisions of local authorities by which some had approved the installation of mechanical stokers while others had insisted on oil burning. He was not in agreement with Mr. Barnes concerning the employment of skilled operators.

Councillor Perotty of Fulham, said that success in the introduction of smoke control areas in Fulham had been due to the co-operation of the public. There were too many exemptions already in the Clean Air Act. He feared that if industry was allowed to make smoke in a smoke control area then the co-operative attitude of the public towards the introduction of smoke control areas might be lost.

Dr. Burnett disagreed with Mr. Barnes concerning qualifications of Public Health Inspectors to judge of matters concerned with combustion. In the North West at any rate they had many competent men. Preston had compulsory powers of prior approval for new furnaces under a private act of parliament obtained before the passing of the Clean Air Act and there had been no report of disagreement between industrialists seeking prior approval and the local authority. Industrialists felt that it was to their advantage to obtain the observations of the local authority before money was spent on new plant. Dr. Burnett emphasized that smoke control areas were not only concerned with domestic smoke and such a view was most unfair to the householder. He said that the Society was not against coal but against air pollution; he also stressed that Ringelmann 2 must not be accepted as standard for industry.

Mr. Hodgson of the National Coal Board pointed out that the Beaver Report had said that industry need not emit more than a light haze of smoke when burning bituminous coal. The Minister had also stated in debate during the passing of the Clean Air Act that " It was generally accepted that furnaces could be used with very little smoke." The situation before the introduction of the mechanical fireplaces order was inequitable to the National Coal Board and the coal industry since it tended to favour oil burning. Mr. Hodgson said that the Board would guarantee the right fuel for each kind of stoker.

Mr. Hodgson was followed by Mr. Lester Horne (Charrington, Gardner, Locket & Co.). Mr. Horne said that industry was doing its utmost to implement the Clean Air Act and that this was costing it not a little expenditure and trouble. He said that the idea which seemed to be prevalent that vested interests were against the Society was a mistake.

Mr. Clinch, Individual Member, asked whether the installation of the minimum equipment would be regarded as meeting the order. There could be considerable disagreements on prior approval of apparatus. Mr. Clinch said that he was shocked at the remarks made by the opening speaker concerning the qualifications of Smoke Inspectors. He had himself conducted examinations for Smoke Inspectors and it was quite wrong to suggest that Public Health Inspectors were not qualified to deal with combustion matters.

Councillor Watson of Scunthorpe, said that if mechanical stokers were not operated properly then trouble would follow. Installation of instruments and equipment was not a guarantee of smokeless operation. There was a human element involved and he had known cases where the equipment had been neglected or interfered with in such a manner as to make it impossible to control combustion efficiently and thus avoid the emission of smoke.

Mr. Innes, Chairman of the Society, said that the regulations did not apply to Scotland and that there was some doubt whether they would be applied. He agreed with the Fulham Councillor that the good will of the public must be maintained and that there was a danger of this being forfeited if industrialists were thought to be receiving preferential treatment. Mr. Innes pointed out that sprinkler stokers could not be operated smokelessly.

Miss Boyd, Individual Member, asked if the technical difficulties had really been solved or not. If they had then this should be made quite clear and if not remaining difficulties should be explained. The present doubtful situation made it very confusing for those who had to explain the position to the domestic consumer.

Mr. Arnold Marsh, Director of the Society, said that there was no antagonism against mechanical stokers as such and in fact the Society had always urged their adoption.

Mr. Barnes in his reply to the discussion said that if mechanical stokers went into premises in smoke control areas then the owner could still be prosecuted for making smoke. However very little smoke was now emitted when stokers were used. The law must not be too stringently administered or it would become ridiculous. The mechanical stoker was undoubtedly the tool for the job and got over the technical difficulties of using bituminous fuel smokelessly. In reply to those who maintained that smoke

(*concluded on page 216*)

CLEAN AIR ACT CASES

Section 1—Hayes and Harlington

A summons taken out by the Council against Powell Duffryn (Carbon Products) Ltd. for permitting the emission of dark smoke from a boiler house chimney for a longer period than that permitted by the Dark Smoke (Permitted Periods) Regulations 1958, was heard before the Uxbridge Magistrates on December 17th, 1959. The Company was represented by Counsel who entered a plea of not guilty. A lengthy hearing ensued during which an attempt was made to establish exemption under Section 2 of the Act. It was stated, for the Company, that chain grate stokers were on order to replace the existing coking stokers.

The Council's case was found proved and the Company was granted an absolute discharge with 5 guineas costs awarded to the Council. Since the hearing the new automatic stokers have been installed and are giving every satisfaction. It is understood that economies resulting from them will pay the capital costs of the installation in three years.

Section 1—Thurrock

J. W. Pigg & Sons Ltd. were fined £10 at Grays Magistrates' Court on November 27th, 1959, in respect of the emission of dark smoke from one of their bakehouse chimneys for a period of 10 consecutive minutes. The case was brought by Mr. H. A. Gosling, C.P.H.I., of Thurrock U.D.C.

Section 1—Stockport

Following a chimney smoke check at the Essoldo Cinema, Wellington Road South, Stockport, the Essoldo Cinema Circuit was fined £2 at Stockport.

Section 5—Halesowen

Harold Andrews Sheepbridge Limited were prosecuted at Halesowen on Tuesday, January 5th, 1960, under Section 5 of the Clean Air Act, 1956. The firm pleaded guilty and were fined £10. The Deputy Town Clerk, Mr. T. J. Edwards, said that the Chief Public Health Inspector, Mr. A. Archer, had drawn the company's attention to the unnecessary emission of grit and dust from the premises on several occasions. When the foundry was visited on October 20th, 1959, no means were being used to prevent the emission of grit and dust from two cupolettes. Mr. N. Robinson, defending, said the firm had spent £1,900 on dust collecting units and he assured the Court that dust arresters which were being specially designed for the cupolettes would be fitted as soon as possible.

Section 11—Huddersfield

Gledhill Brook Time Recorders Ltd., 23 Market St., Huddersfield, who were charged with emitting smoke from their Empire Works, a building in a smoke controlled area, were given an absolute discharge on payment of 4s. costs at Huddersfield Borough Court on January 4th, 1960.

Mr. E. T. Mather, prosecuting, said that under the Huddersfield (Buxton Road-New Street) Smoke Control Order, it was an offence to emit smoke from any building. A public health inspector kept observation on the firm's chimney on October 1st, the first day that the Order came into effect. There was a continuous emission of smoke for six minutes. Mr. Mather said, " This is not put up as being a bad case. The smoke emitted was of the lightest shade. But the local authority do think that the time has come for a prosecution. This affects the public very much."

Section 20—Liverpool

The Liverpool Stipendiary Magistrate (Mr. A. McFarland) on November 11th, 1959, warned tug owners that he would inflict heavier penalties in future if the clean air regulations were not observed. He imposed a fine of £5 on the Liverpool Lighterage Co. and two fines of £5 each on the Liverpool Screw Towing & Lighterage Co. for offences under the Act. Both companies pleaded guilty. Mr. Michael Green, prosecuting, said that a public health inspector saw black smoke being emitted from the tug " Langbourne," owned by the Liverpool Lighterage Co., for a total of 11 minutes in a period of half-an-hour on October 16th.

Mr. Green said that the inspector also saw black smoke being emitted from two tugs owned by the Liverpool Screw Towing and Lighterage Co. Black smoke was emitted for six minutes from the " Grebe Cock " on October 15th, and for a similar period from the " Black Cock " on October 20th. For the defendants it was stated that they did all they could to see that the regulations were observed. The difficulty was that tugs were frequently called upon to get up steam at short notice and at irregular intervals.

Pointing out that the maximum penalty was £100, the Stipendiary Magistrate said: " I shall be more severe if the regulations are not complied with. It cannot be said that they have not been warned."

Section 20—Liverpool

North West Tugs were fined for emitting black smoke from a tug for a period of 15 minutes in half-an-hour. The offence occurred when the crews of a tug were changing over, the fireman being anxious that there should be a good head of steam to enable the vessel to sail at a moment's notice if required by the new crew.

Section 20—Liverpool

J. H. Lamey Ltd., tug owners, Water Street, Liverpool, were fined £5 at Liverpool City Magistrates' Court on November 18th, 1959. Mr. Michael Green, prosecuting, said that on October 22nd a public health inspector saw black smoke emitted from the tug " J. H. Lamey " for a period of 10 minutes. Later, the secretary said the company was doing all it could to ensure that the Clean Air Regulations were observed. Imposing the fine, Mr. A. McFarland (Stipendiary Magistrate) said he would treat the company in the same way as previous offenders, since the offence was committed before his warning of the previous week, of more severe penalties in the future.

Section 20—Manchester

The Westminster Dredging Co. were fined £20 for an offence against the Act on September 2nd, 1959. A summons in respect of a similar offence on May 8th, 1959, was dismissed. Mr. J. B. D. Haynes (prosecuting on behalf of the Port of Manchester Health Authority) said that on May 8th the dredger " Europa " was in the Eastham Channel. Black smoke poured from the funnel for 20 minutes, and dark smoke for a further five. On September 2nd the dredger " Saturnus " was in the channel with black smoke pouring from the funnel and blowing across towards Eastham ferry, where there were houses and a hotel.

Mr. J. W. Bateson (defending) said the Act required ship owners to be notified of alleged offences within 48 hours. His clients had not received notice of the " Europa's " alleged offence until May 12th. He said that the Act provided a defence when it could be proved the defendants were doing all possible to stop the nuisance. Mr. Christie (manager of the company) said that they had tried South Wales steam coal, but even with that had complaints from local authorities.

Section 20—Bristol

The owners of a steamship, which was alleged to have emitted black smoke at Avonmouth Dock, were fined £5 at Bristol on December 2nd, 1959. The Pacific Steam Navigation Co. pleaded guilty to the offence, which was committed by the s.s. " Flamingo " on October 2nd. Mr. W. G. K. Thurnall, prosecuting, said that black smoke was seen coming from the s.s. " Flamingo's " funnel for 10 minutes. Mr. D. M. Charles Jones, defending, said that the offence had been committed because there had just been a change in the ship's engine-room crew, and the new men were not familiar with the engine-room equipment.

Section 20—London

A London Port Health Authority Inspector travelling in a launch watched the steamer " Windsor " sail from Barking Reach, through Half Way Reach and into Erith Reach, and noticed that over a period of 30 minutes the ship emitted black smoke consistently for 19 minutes. On December 10th, 1959, Dartford magistrates fined the " Windsor's " captain, Algernon Brinsley Sheridan, and the North Thames Gas Board, owners of the vessel, £20 each for emitting black smoke. No costs were awarded against Captain Sheridan, but the Gas Board were ordered to pay prosecution costs of £10 10s.

ROAD TRAFFIC CASES

Bury St. Edmunds

Eight drivers and owners of diesel lorries were summoned at Thingoe Court on January 20th, 1960, for using vehicles not maintained so that smoke was not emitted which might cause danger to persons or property. In each case the magistrates granted a conditional discharge for 12 months, the chairman, Major L. Lithgow, saying that they hoped it would serve as a warning to lorry drivers and owners that they needed to be extremely careful.

Sevenoaks

Stanley Elwill, 7 Wentworth St., Liverpool, and his employers, Hygena Ltd., were each fined £1 by Sevenoaks magis-

(*concluded on page 216*)

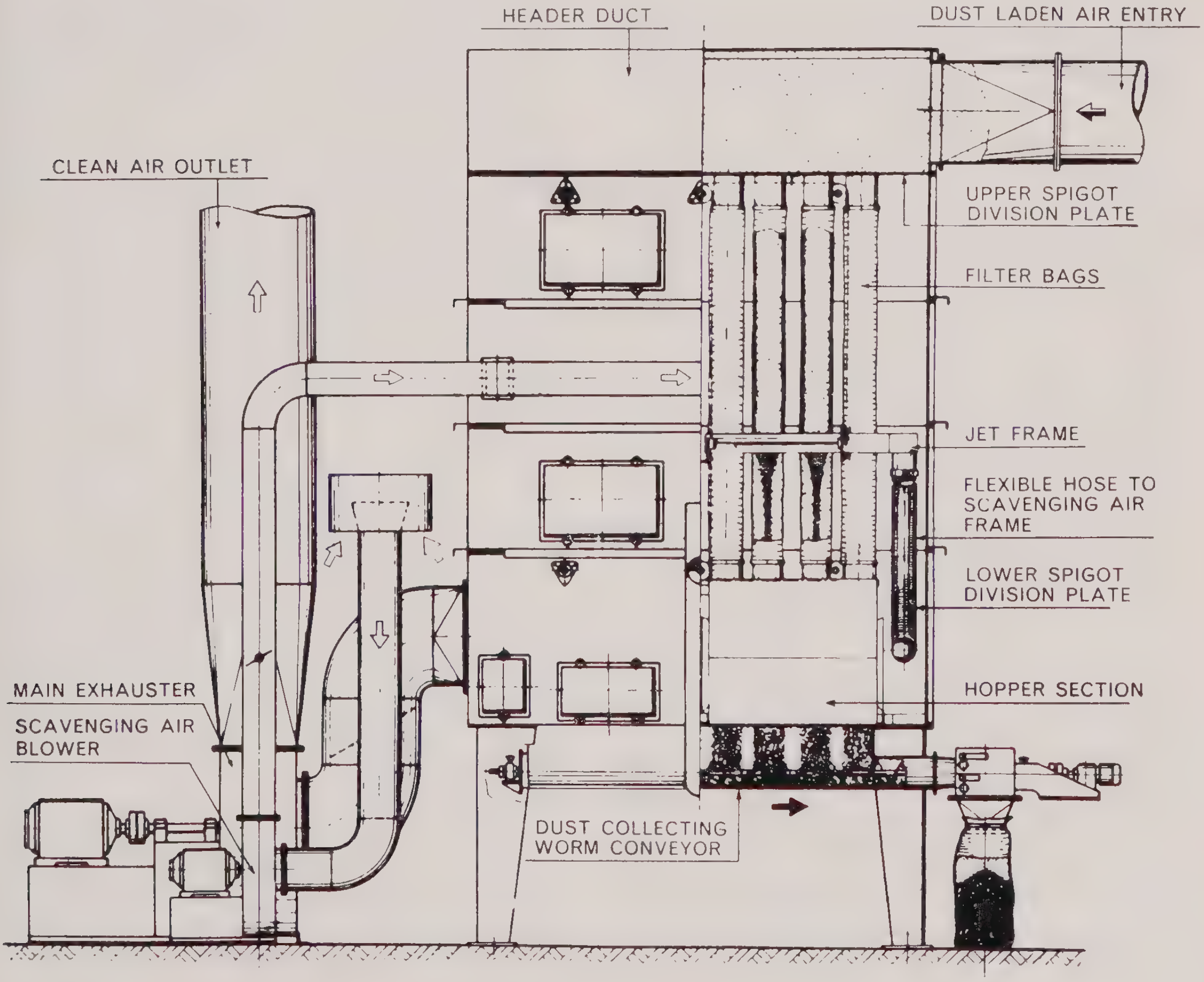
HOLMES-RETROFLUX BAG FILTERS

A further addition to the range of dust collection and control plant manufactured and marketed by the Gas Cleaning Division of W. C. Holmes & Co. Ltd. is the Holmes-Retroflux Bag Filter. This filter was developed by Standard Filterbau Gesellschaft m.b.H. of Munster and is to be manufactured under licence in the United Kingdom.

The Holmes-Retroflux Bag Filter has numerous advantages over conventional bag filters and is particularly suitable for those applications where high dust burdens are encountered and/or dusts of an adhesive nature have to be collected. It is of advanced design and has an extremely efficient and continuous method of cleaning the filter bags which ensures that large volumes can be handled with constant pressure drop and high collection efficiency. An efficiency in excess of 99 per cent. for all particles, including those of sub-micron size can be guaranteed.

In operation, the dust laden air enters the header within the casing and is distributed to the inside of the filter bags, the air and dust moving in the same direction. The tendency of the dust to settle by gravity is not impeded by air currents as the air passes through the filter bags radially and the air velocity gradually diminishes to zero at their lowest end. The dust collected on the inner surface of the filter bags is continuously dislodged by the passage of high velocity air jets through the fabric in the reverse direction to the main air stream. The dislodged dust falls by gravity to the worm conveyor or hopper below. The use of high velocity air jets is a design feature of the Holmes-Retroflux Bag Filter which dispenses with the rapping or shaking mechanism and separate compartments encountered in other types of bag filters.

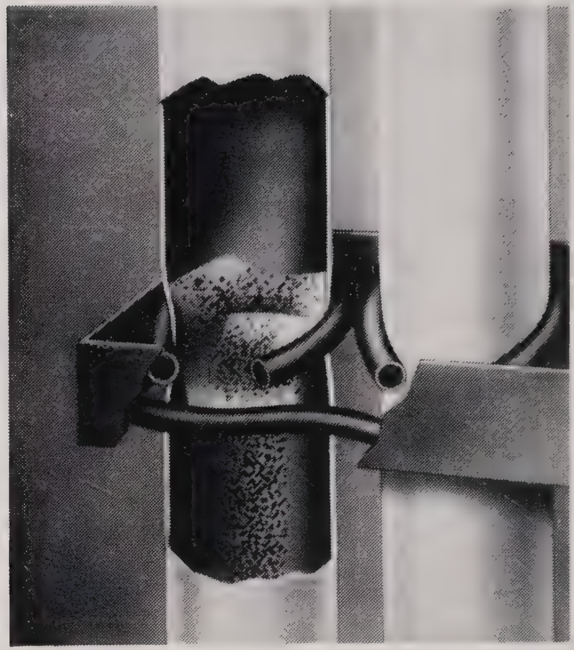
The jet tubes have a narrow slot in the face which is in contact with the filter bag and are specially shaped and finished to avoid damage to the fabric. The ends of the tubes are set in hollow frames which are suspended by chains, and are supplied with high pressure air from a blower via a


HEADER DUCT
DUST LADEN AIR ENTRY
CLEAN AIR OUTLET
UPPER SPIGOT DIVISION PLATE
FILTER BAGS
JET FRAME
FLEXIBLE HOSE TO SCAVENGING AIR FRAME
LOWER SPIGOT DIVISION PLATE
MAIN EXHAUSTER
HOPPER SECTION
SCAVENGING AIR BLOWER
DUST COLLECTING WORM CONVEYOR

flexible hose. The frames operate in counter balanced pairs when large volumes of air are being filtered; each frame is capable of cleaning the complete length of up to 36 bags.

The jet tubes are mounted in pairs, one pair being positioned approximately 3 in. below and at 90 degrees to the other so that progressive cleaning of the filter bags can be achieved efficiently and without damage to the fabric. Each jet tube is in contact with the surface of the bag over a quarter of its circumference only, and in operation the bag becomes slightly elliptical in shape as each pair of tubes travels along its length. This arrangement of the jet tubes ensures that the bag is not constrained in any way; creases do not form in the fabric and wear is reduced to such an extent that filtering media such as glass fibre can be used successfully when handling hot flue gases. The reciprocating frames carrying the reverse jet tubes travel at very slow speed and this also reduces wear and tear on the material of the filter bags.

A major advantage that the Holmes-Retroflux Bag Filter has over other types of bag filters is that each filter bag is continuously and efficiently cleaned over its entire surface area. The high velocity yet of air which passes through the fabric is measured in thousands of feet/minute compared with less than ten feet/minute for the normal filtering air speed through the filter bag. This high efficiency cleaning cannot be effected by some types of bag filters in which the reversal of flow of clean air during the shaking operation is at comparatively low velocity. One important result of this efficient cleaning is that the filter resistance can be maintained at approximately half of that normally experienced with a conventional bag filter without sacrificing any drop in efficiency. An appreciable saving in power consumption is therefore achieved.



A cut-away view showing a section of hollow frame, and jet tubes around the two filter bags

The Holmes-Standard Bag Filter, which is a combination of a conventional circular bag filter and cyclone is also to be manufactured under licence. This filter has an equally high efficiency and is recommended for less arduous duties.

Mechanical Stokers—(*concluded*)

control areas were not only to deal with domestic smoke he said that that was the impression given by the Ministry memorandum.

Mr. Hayward, replying, said that his company manufactured sprinkler stokers and he agreed that they would only burn a very restricted range of coals but given coals within that range they could be used without making smoke. He pointed out that if any particular type of stoker was not effective in preventing smoke then a large number of prosecutions would result and the bad reputation thus acquired would result in that type of stoker going off the market.

The Chairman at the meeting was Alderman C. H. Smith, O.B.E., J.P., Chairman of the South East Divisional Council of the N.S.C.A.

Road Traffic Cases—(*concluded*)

trates for using a vehicle emitting excessive smoke at Seal on October 27th, 1959. Chief Inspector B. R. Powell, prosecuting, said that P.C. Chapman saw Elwill driving a pantechnicon goods vehicle which was emitting a cloud of dense black smoke.

Correction.—The case reported on p. 108 of our last issue (Winter, 1959) under the heading " Uxbridge," was in fact taken by the Hayes and Harlington U.D.C.

Development of Clean, Automatic Bituminous-Coal-Burning Equipment of Small-Industrial and Residential Capacities*

by

Harold J. Rose and James R. Garvey

Bituminous Coal Research, Inc., Pittsburgh

In most areas of the United States, fuel oil or natural gas is available at moderate cost. In order to protect the competitive position of bituminous coal, it has been necessary to develop equipment which will burn coal in clean and automatic ways.

The manufacturers of boilers, coal burners and auxiliaries for power plants have long been active in providing clean, efficient and automatic coal-burning equipment for large and medium-sized plants. However, it became evident some years ago, that the manufacturers of " commercial and small industrial " and " residential " sizes of heating equipment were concentrating their development programmes on oil- and gas-fired equipment, and in general were not willing to devote similar efforts with their own facilities to improving coal-burning equipment.

Such development work was therefore undertaken by Bituminous Coal Research, Inc., the national research association for bituminous coal. When feasible, the projects have been undertaken co-operatively with equipment manufacturers.

Exacting specifications were prepared as guides for developing new coal-burning equipment and for evaluating its performance. The numerous requirements include (1) effective control of smoke and dust in stack gases, and of dust from handling coal and ash, (2) fully automatic operation, that is, automatic feeding of coal from the bin; appropriate controls for the combustion, banking and pick up cycle; and automatic ash removal, (3) " package " design, that is, boiler, burner and controls are to be shipped as a factory-assembled unit for ease and economy of installation, and (4) the units must burn as wide a range of coal as possible as regards caking properties, ash fusibility, volatile matter, etc.

At the same time, manufacturing costs have to be held down so that the somewhat higher first cost of such equipment can soon be repaid by the saving in fuel costs resulting from the use of coal instead of fluid fuels.

These programmes have resulted in clean automatic coal-burning equipment of several types and capacity ranges, which have passed through the laboratory research, engineering design and field-testing stages, and are now being sold commercially. Following are examples:

Commercial and Small Industrial

Coal-Pak Automatic. This package boiler, shown in Figs. 1 and 2, is manufactured in six sizes ranging from 2,400,000 to 10,050,000 Btu per hour for hot water, and from 2,470 to 10,350 lb. steam per hour for either low pressure or high pressure steam installations. It is a highly efficient

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* Manuscript prepared for Diamond Jubilee International Clean Air Conference, but received too late for inclusion in the Proceedings.

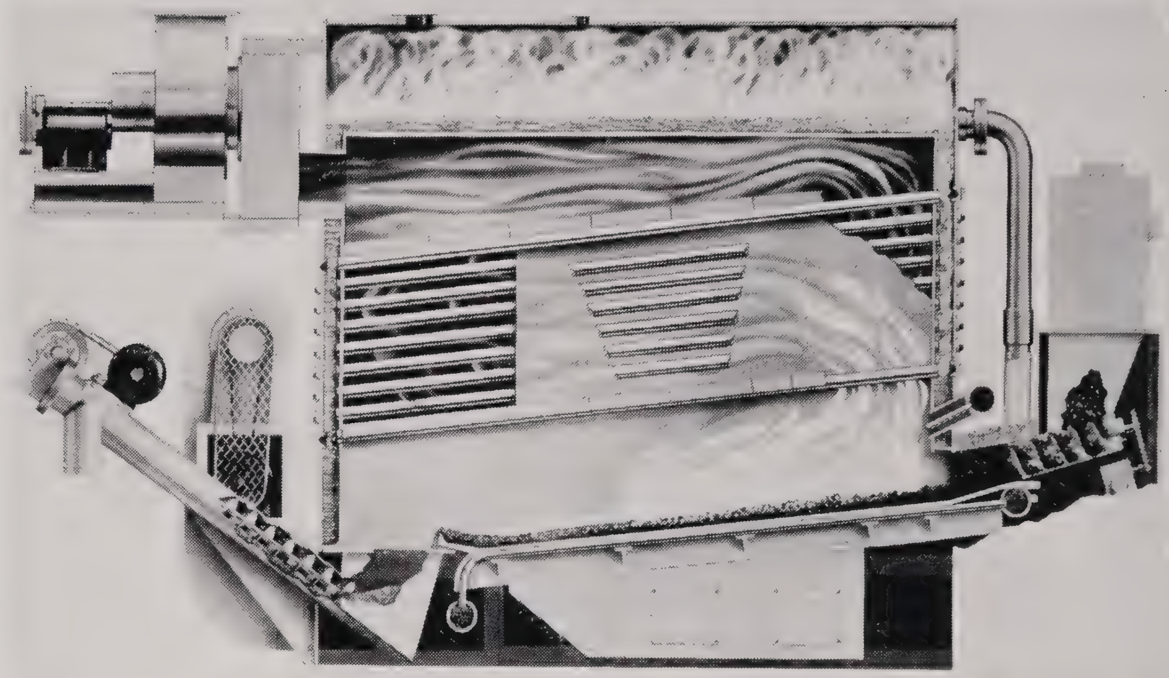

Fig. 1. *IBW-BCR Coal-Pak Automatic Packaged Boiler. Cut-away drawing showing from right to left: automatic coal feed, pulsating water-cooled grate, five-pass water tube boiler, and automatic ash removal system*

unit which burns a wide variety of coals on a pulsating crossfeed grate; automatically operates through a wide load range, maintains a banked fire and starts up from a banked condition; and removes ash continuously.

The boiler, controls and grate are BCR inventions. The Coal-Pak Automatic is being manufactured under licence and sold in the U.S.A. by The International Boiler Works Co., and a non-exclusive licence has been issued to a Canadian manufacturer. Business arrangements with BCR have recently been completed by an English firm, which will enable them to produce this automatic unit in Great Britain.

Fire Jet Burner. This burner was originally sold for use with anthracite, but at the request of the manufacturer, General Machine Co., it was redesigned by BCR to use bituminous coal. This stoker, shown in Fig. 3, is suitable for installation in existing or new low-pressure steel boilers in the size range 4,350 to 12,000 sq. ft. EDR of steam, or 115 to 325 lb. coal per hour.

Heating loads such as schools, churches, apartments, barracks, etc., can be handled, using multiple units if necessary for the larger loads. The coal feeds from a hopper by gravity on to a water-cooled reciprocating cross-feed grate. Ash that is relatively clinkerless and low in carbon is discharged from the end of the grate. Overfire air is used for smoke prevention. The Fire-Jet provides clean, essentially automatic operation with free-burning types of bituminous coal, and has been used in some cases with more strongly caking high-volatile coals.

Residential Heating Units

Central heating of residences is general in the United States. The widespread availability of fluid fuels which can be burned automatically in moderate-priced equipment has been a severe challenge to bituminous coal for residential uses. Underfeed stokers are used extensively but are rather exacting as to coal characteristics, and most models require manual removal of ash in clinkered form. BCR has been active in developing or improving various types of smokeless automatic equipment for house heating.

BCR Downflow Stoker-Boiler. This is a completely automatic home-

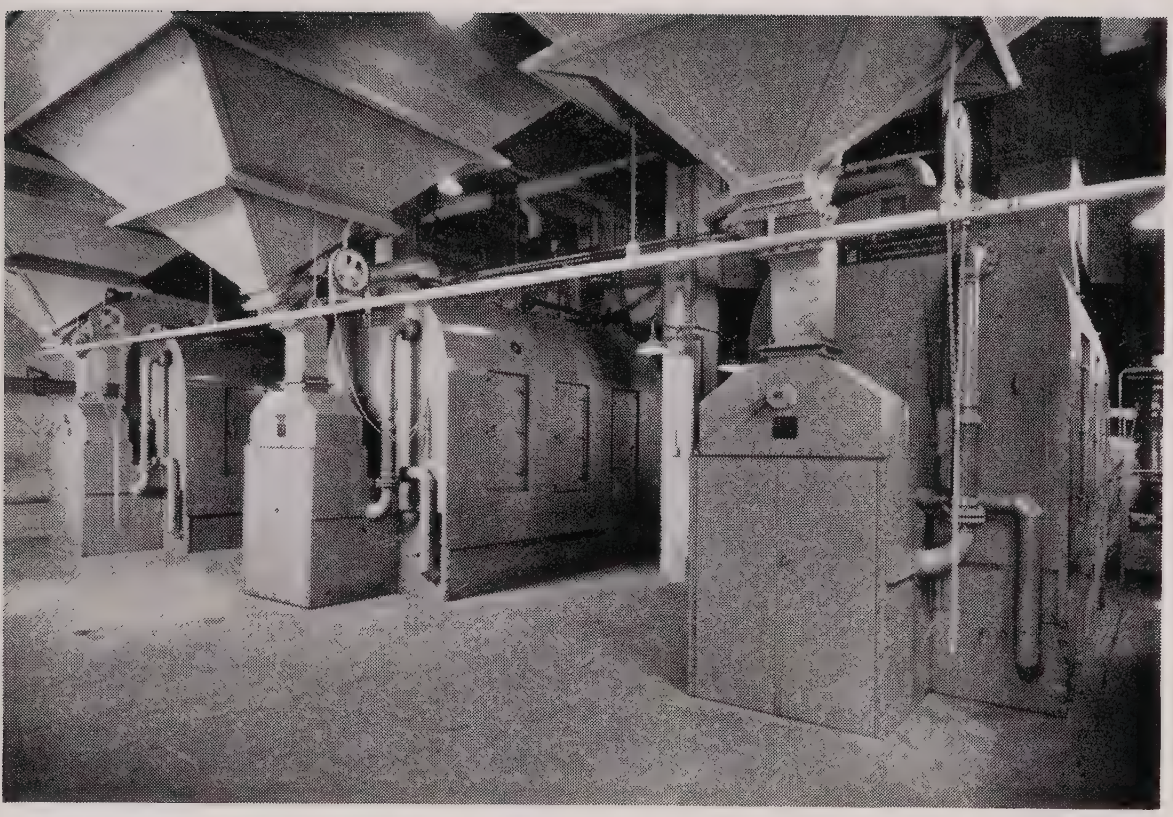

Fig. 2. Coal-Pak Automatics in boiler room of Otterbein College, Westerville, Ohio. Two 200 *h.p. hot water boilers and one* 200 *h.p. low pressure steam boiler. Connected load about* 16,000,000 *B.T.U. per hour*

heating unit which requires practically no attention from the householder. It can burn a wide variety of caking or non-caking coals of high or low ash-softening temperature and deposits the ashes in a sealed container located either indoors or outdoors. The unit developed has a capacity of about 15 lb. coal per hour. A number of these units under the name of " Dosco Downdraft " have been manufactured and sold in eastern Canada through the efforts of a BCR member company.

Coal-O-Matic Furnace. Originally an anthracite burner, this has been developed into a bituminous coal burner in the BCR laboratories in co-operation with the manufacturer, Dallas Engineers, Inc. As shown in Fig. 4, coal is screw fed from the bin to a flat inclined cross-feed grate from which loose ashes discharge to a metal container for easy disposal. Several hundred of the 95,000 Btu per hour warm-air units are in regular residential use, burning a variety of free-burning bituminous coals from several states. Other sizes and types have been tested.

Stokermatic Heater. Many thousands of heaters manufactured by Stokermatic Company, have been sold

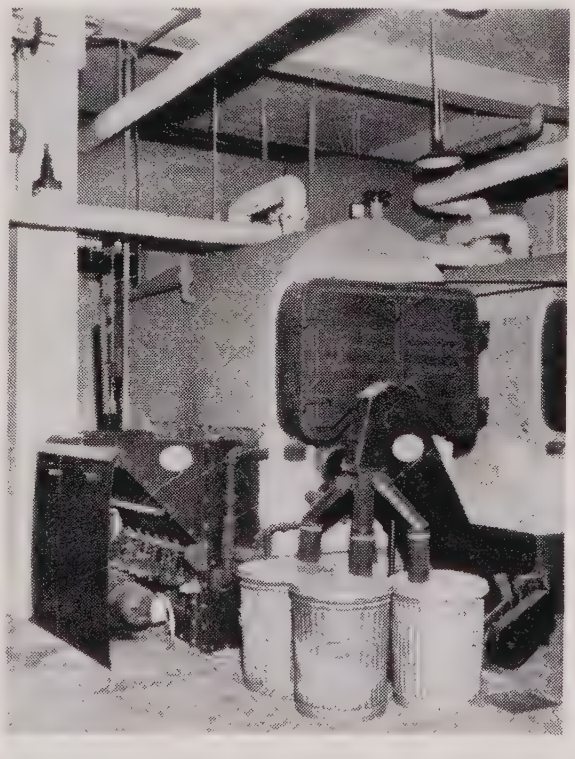

Fig. 3. Fire-jet installation at Fort Knox, Kentucky. One 60*-inch burner rated at* 230 *lb. coal per hour in* 13,600 *EDR fire-tube boiler*

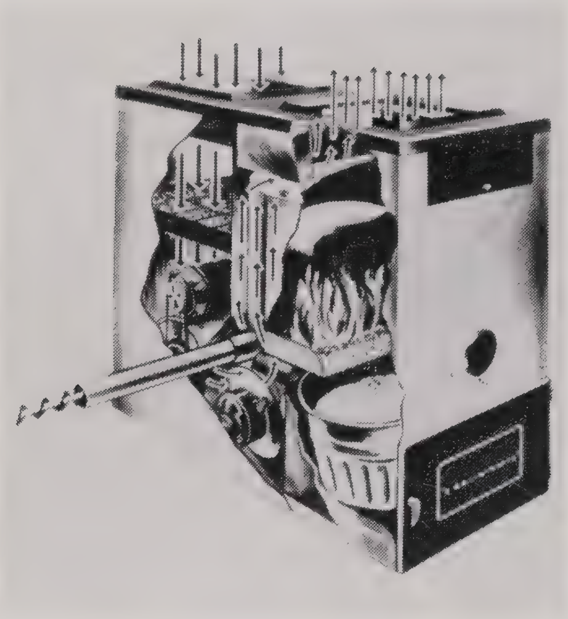

Fig. 4. Coal-O-Matic combining stoker, furnace, ash container, blower and air filter in one unit. Coal screw at left feeds pan-type burner

for use with free-burning Western coals. BCR made systematic tests with various Eastern bituminous coals, and suggested design changes which make the unit suitable for bituminous coals except the strongly-coking types. The Stokermatic consists of a small conventional underfeed stoker, coal hopper, warm-air heat exchanger, circulating fan and thermostatic controls housed in an attractive cabinet which is placed in the living quarters of a four or five-room house.

Magazine-Feed Smokeless Stoves and Furnaces. BCR has also sponsored the design and field-testing of thermostatically controlled magazine-feed residential stoves (room heaters) and central warm-air furnaces which have been officially approved as to smokelessness and which reliably magazine-feed bituminous coals having a wide range in volatile matter, coking properties and ash fusibility. Coal addition and ash removal are manual, but are required only once in 24 hours or so. These smokeless magazine-feed appliances are not being manufactured in the United States because market conditions are unfavourable at present. However, a Canadian manufacturer is licensed to produce the smokeless stove.

Summary

The results summarized in this paper have shown beyond a question that clean, fully-automatic equipment of various types and capacities can be developed for bituminous coal, and can be manufactured and sold to give consumer satisfaction. However, commercial marketing efforts in the field of smaller automatic coal-burning appliances have been rather limited recently in the U.S.A., because of economic and competitive conditions affecting the coal industry.

Sale and Service of Small Coal-Burning Equipment

Bituminous Coal Research, Inc., co-operates closely with Bituminous Coal Institute which is concerned with the engineering applications of coal in various markets, and with Automatic Solid Fuels Equipment, Inc., which is sponsored by the coal industry to handle sales and service of new and improved coal-burning equipment of residential and small-commercial capacities.

Electric Heating

Another approach to the clean and convenient use of bituminous coal for heating purposes, is the use of electricity from coal-burning utility power plants for residential and small-commercial heating and air-conditioning purposes. In 1958, U.S. electric utility plants burned 156 million tons of coal, which provided 53 per cent of their total electricity output from all fuels and hydroelectric sources. Residential and commercial markets represented 46 per cent of total electricity sales, and the total consumed by these markets is increasing steadily. At the present time there are about one-half million electrically heated homes in the United States.

Copper Oxide—A Possible Anti-Smog Catalyst?

Research at the University of California indicates that copper oxide is a possible catalyst for breaking down and eliminating smog-producing gases present in car exhaust fumes.

AIR POLLUTION ABSTRACTS

429. Determination of Sulphur Trioxide and Sulphur Dioxide in Flue Gases, The. Fielder, R. S. et al. (J. Inst. F. **33,** 84-89, Feb. 1960). A compact portable apparatus and a simplified technique have been developed for the rapid determination of the concentrations of sulphur trioxide and sulphur dioxide in flue gases. The turbidimetric determination of sulphur trioxide used by previous workers has been modified. The more sensitive procedure evolved requires at most a ten-litre sample of flue-gas for a determination, and determinations may be made at an average rate of one every 15 to 20 minutes. The apparatus and method described have been used extensively in the field and in the laboratory and have proved convenient and reliable.

430. A Routine Sampler for Detecting Variations in the Emission of Dust and Grit. Lees, B. and Morley, M. C. (J. Inst. F. **33,** 90-95, Feb. 1960). The Report of the Committee on Air Pollution, 1954, recommended that simpler standard methods of sampling flue gases to determine grit emission should be devised. The sampler described has been developed for routine sampling on a comparative basis. It is extremely simple, yields consistent results and requires only a few minutes per day for routine control. Its application is described for assessing on a routine basis the efficiency of collection of grits by mechanical arrestors and the performance efficiency of electrostatic precipitators on boilers fired with pulverized coal.

431. Clean Air Act: Requirements and Application, The. Opie, C. M. (J. Inst. F. **32,** 421-425, Sept. 1959). The Clean Air Act, 1956, forbids the emission of dark smoke except for short specific periods, and requires that grit and dust shall be reduced by fitting efficient grit arrestors. In addition to strengthening control over industrial smoke, it provides for the prevention of smoke from domestic houses. The other provisions of the Act are outlined. The application of the Act raises problems in so far as: (1) To conform with the Act technical improvements in installation and plant operation will be necessary. (2) These improvements should be economic in operation and not interfere with the working of the plant. (3) The principal difficulty is how to burn bituminous coal of all types and grades in a variety of appliances under different, and at times difficult, conditions. Local authorities are given the duty to enforce the provisions of the Act, but consideration should be given to the difficulties, technical and financial, of industry in effecting a permanent improvement in atmospheric pollution.

432. Influence of Bottom-grate Air Space on Performance of the Open Fire. Fox, L. L. and Heselden, A. J. M. (J. Inst. F. **33,** 17-22, Jan. 1960). The object of the work described in this paper was to distinguish between the effects of firebar spacing and of the percentage of free air space in the bottom-grate of an open fire. From an analysis of series of flying start tests on a fire with eight different, interchangeable bottom-grates, partial regression coefficients were found for the effect on radiant efficiency of firebar spacing, percentage of free air space, and radiation output.

433. Areas Within Concentration Isopleths Downwind of Continuous Point Source. Elliott, W. P. (Int. J. Air Poll. **2,** 115-126, Oct. 1959). Empirical formulae for estimating the area covered by concentrations of gas equal to or exceeding a given value are presented. These formulae are derived from regression lines of the value of the logarithm of the area against the logarithm of the critical concentration divided by the source strength and the logarithm of the concentration divided by the source strength and multiplied by the wind speed at 2 m. The scatter about the regression lines is reduced if one stratifies the entire sample by means of certain parameters.

These parameters are: stability ratio, a measure of the atmospheric thermal stability which is the difference of the temperatures at 4 m and $\frac{1}{2}$ m divided by the square of the wind at 2 m; the temperature difference alone; and the standard deviation of the horizontal wind direction. The first parameter was found to reduce the scatter the most and the last parameter reduced the scatter the least. The results are presented in the form of tables of the regression coefficients and illustrated in a graph. Generally speaking it is found that the logarithm of the area, A, was linearly related to the logarithm of the concentration, χ, divided by the source strength, Q, and multiplied by the wind speed, u, in the form $\log A = a \log (\chi u/Q) + b$. When the variables are expressed in c.g.s. units a varies from about —0·6 to —1·2 and b varies from about 2 to 7 as the atmosphere passes from unstable to stable.

The data used to arrive at these results were taken over level prairie land with short grass. The tracer was sulphur dioxide emitted continuously from a point source about $\frac{1}{2}$ m from the surface. Measurements were out to a distance of about 800 m from the source.

434. Notes on the Exchange of Iodine between the Atmosphere, Land and Sea. Bolin, B. (Int. J. Air Poll. **2,** 127-131, Oct. 1959). The deposition of ^{131}I as observed in small scale experiments and also after the Windscale incident, are interpreted in the light of available measurements of ^{127}I in the atmosphere and in plants. It is shown that the deposition velocity deduced from deposition of radio-iodine is representative of the gross transfer while the net flux from the atmosphere to a land surface is several orders of magnitude smaller. The observations show that plants use atmospheric iodine for their assimilation and that this may be their major source in spite of the indication that a larger portion of the atmospheric iodine is present in organic form and not readily available for assimilation. Finally a residence time of 20 days for iodine in plants is deduced.

435. Measurements on the Content of Non-Volatile Organic Material in Atmospheric Precipitation. Neumann, G. H., et al. (Int. J. Air Poll. **2,** 132-141, Oct. 1959). A method is described for the determination of the non-volatile organic carbon and the total nitrogen content in atmospheric precipitation. The fall-out of organic carbon was measured at nine stations in Sweden over a period of four months for one test series. Geographically the distribution of organic carbon was found to be fairly constant over the total sampling region averaging 160 mg carbon per square metre per month. In a second test series the ratio organic carbon to total nitrogen (ammonia plus organic nitrogen) was also determined. This too was found to be fairly constant irrespective of the sampling place. It is concluded that the organic carbon in the atmosphere has a very extended source region. It is further suggested that the sea surface might play an important role as a provider of organic material found in the atmosphere.

436. Methods of Sampling and Storage of Air Containing Vapours and Gases. Baker, R. A. and Doerr, R. C. (Int. J. Air Poll. **2,** 142-158, Oct. 1959). This study was made to determine the effect of various storage techniques and materials on known concentrations of gases in air. These gases were studied as single components and as complex mixtures under atmospheric and compression storage conditions. Storage was in steel cylinders, plastic bags and glass flasks at varying time intervals. Results were monitered by infra-red spectrometry and by gas chromatographic procedures.

Compression storage in steel cylinders at 15° psig resulted in high loss of sulphur dioxide and nitrogen dioxide but little hydrocarbon loss. The compressor was found to affect the mineral oxides, especially sulphur dioxide. This technique appears satisfactory for hydrocarbons. Various polymeric films were fabricated into bags and evaluated as gas storage containers at atmospheric pressure. Moisture, regardless of whether present originally or having permeated into the bag on storage, was a major factor. Mineral oxides disappearance is more rapid at high relative humidity. Hydrocarbons were not similarly influenced. Chemical reaction and permeability are involved with the soluble mineral oxides but diffusional parameters alone control hydrocarbon loss. These statements apply only if the gases are non-reactive with the plastics. Two-film bags may be useful in field testing. The inner film should be impermeable to the gases of interest and the outer film to moisture. Aluminized Mylar was the least permeable to moisture of the plastic films studied. Additional study under conditions of controlled humidity are contemplated to define comparative performance of the films. Gas-liquid chromatography and plastic bags offer potential benefits in field testing of air pollution. Small volumes at low concentrations may be accurately measured if the specific analytical procedure is available. The occurrence of a dark reaction could not be demonstrated after 46 hour storage of a mixture of sulphur dioxide, nitrogen dioxide and 2-pentane. Measurement was by light scattering. Storage of the sulphur dioxide, nitrogen dioxide, 2-pentane mixture in steel cylinders at atmospheric pressure showed no significant loss. Comparable storage in glass flasks showed high loss of sulphur and nitrogen dioxides.

437. Spectroscopic Analysis of industrial Emissions for Nitric Oxide, Nitrogen Dioxide and Sulphur Dioxide. Haagen-Smit, A. J. et al. (Int. J. Air Poll. **2,** 159-166, Oct. 1959). Together with smoke density meters, the automatic recording NO and SO_2 meters are valuable tools in the prevention of excessive emission of air pollutants in flue gases. The NO, SO_2 recorder makes available a research tool for the study of formation and control of oxides of nitrogen and sulphur. The close relation between flame temperature and NO formation should open the way for interesting studies in plant operation. The removal of excess water, dust and sulphuric acid from the flue gas by condensation and electrostatic precipitation is of general application, and has led to a more disturbance-free operation of many types of automatic instruments such as sulphur dioxide, nitric oxide, carbon monoxide, carbon dioxide and oxygen analysers.

438. Longevity of the Phytotoxicant Produced from Gaseous Ozone-Olefin Reactions, The. Arnold, W. N. (Int. J. Air Poll. **2,** 167-174, Oct. 1959). Gaseous mixtures of an olefin and ozone were blown at a constant rate through a 32 ft. tube of uniform cross section. A small aquatic plant was placed at prescribed intervals within the tube. The phytotoxicants produced from the ozonization of both 3-heptane and 2-pentane were shown to be unstable. The distribution of plant damage within the exposure tube indicated the longevity of the phytotoxicant. The reduction in chlorophyll content of fumigated plants was used as a quantitative measure of damage. The results suggest that the decay of the phytotoxicant follows a first-order or pseudo-first order reaction. The half-life of the phytotoxicant from ozonated 3-heptane is $\frac{1}{4}$ hr. while the phytotoxicant from ozonated 2-pentane has a much shorter half-life. This difference in stability can be explained in terms of the " zwitterion " mechanism.

439. Spatial Distribution of Air Pollution in Sheffield, 1957-1959, The. Pemberton, J. et al. (Int. J. Air Poll. **2,** 175-187, Oct. 1959). (1) A study of the distribution of smoke and sulphur dioxide in Sheffield over a two-year period has been made with a maximum number of 30 daily sampling instruments in the second year. (2) Pollution levels were related inversely to elevation but the most important factor, particularly for smoke, was found to be the population density in the area round the instrument. Industrial sources accounted for much of the sulphur dioxide.

(3) Maps have been drawn upon which the pollution means for one complete year, and also for one summer and two winter periods, have been entered at the site of each instrument. The yearly means or smoke for 1958-9, April to March, ranged from 6 to 51 mg/100 m^3, and for sulphur dioxide from 2·1 to 15·2 parts per 100 million. Pollution during the second winter was considerably heavier in most areas than in the first. (4) Although at most sites there was an increase in pollution during the second year as compared with the first, there was evidence of a decrease in smoke in an area near the city centre recently designated as Smoke Control Area No. 1. However, sulphur dioxide levels here as elsewhere showed an increase during the second year.

440. Reliability of Air Pollution Measurements in Relation to the Siting of Instruments, The. Clifton, M. et al. (Int. J. Air Poll. **2,** 188-196, Oct. 1959). (1) A study of the reliability of air pollution measurements has been made. The results will serve as a guide to the siting of instruments and to the accuracy with which the average pollution of an area can be assessed from a given distribution of instruments. (2) If 40 per cent. in either direction is an acceptable limit of error (that is, a coefficient of variation of 20 per cent.) it is necessary to have one instrument every half mile (0·8 km) for daily values, or every mile (1·6 km) for monthly mean values. (3) Eight instruments are required to estimate the average pollution of Sheffield to within plus or minus 20 per cent. of the values obtained by using twenty-eight instruments. (4) A simple method of selecting sites in relation to population density is suggested.

441. Durch Schwefeldioxyd bedingte Immissionsschäden an Obst- und Waldbäumen. (In German.) Berge, H. (Die Gartenbau Wissenschaft, **24(5),** Prt. 2, 220-228). Observations and the results of examinations of the control of immission in the north-eastern part of the industrial area of Nordrhein-Westfalen led to the conclusion that under certain conditions plant analysis forms an important source of evidence in diagnosing smoke injuries. The limiting values for SO_2 noxiousness—claimed by some authors—may only be applied in so wide a range that their usefulness must be doubted. Schedules for the sensibility of plants are only of local and temporary value. The applicability of comparative plant analyses to smoke injuries is demonstrated by examples. The sensibility of species and varieties of fruit and forest trees must be recognized. A number of examples shows that by parasitic attack or illness the SO_2 absorption or symptoms of smoke damage respectively, are increased. For several tree species the seasonal total content of sulphur (given as SO_2) in the foliage is shown by curves, which prove in accordance with those obtained by Meetham (14) with the atmospheric SO_2 content in Leicester. In spite of apparent difficulties the control of immission, *i.e.* the supervision of the influences on plants, is preferable to the control of emission, *i.e.* the supervision of exhalations of gas, dust, or smoke compounds.

Survey of a Proposed Smoke Control Area

This is the title of a paper, written from practical experience, by W. J. Wotton, District Public Health Inspector, Croydon, published in the February, 1960, issue of *The Sanitarian*, journal of the Association of Public Health Inspectors.

OVER

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Waste Material Destructors

The problem of the disposal of refuse has been worsened by the passing of the Clean Air Act, for refuse cannot be burned in within the combustion chamber of a boiler plant that has been converted to oil or mechanical firing. A. B. Scorer Ltd. manufacture a range of refuse destructors which can handle between 80 and 750 lb. of refuse per hour, although this figure may vary due to density.

Standard destructors can be supplied with or without dust catchers of the water trough type or non-mechanical arrestors of the centrifugal pattern. Where wet refuse with a low calorific value is to be disposed of, gas or oil firing can be used to start and if necessary maintain ignition. In some cases it is possible, however, to dry the refuse on a special hearth within the furnace.

In addition to the standard range of destructors, A. B. Scorer built special equipment to deal with a wide variety of materials, using the heat produced for steam and hot water.

Electric Firelighter

A prototype electric firelighter, which it is claimed, can light five fires for a 1d. (assuming a 10 minute igniting time for each fire) was demonstrated by the Central Electricity Generating Board on October 27th, 1959, at its Hill Top Domestic Appliance Testing Station, Walkden. The device has been developed as a result of demand from smoke control areas and a number of Public Health Inspectors were present at the demonstration.

The firelighter is built roughly on the " hair dryer " principle in that a jet of air is blown past a heated electric element. It was successful in igniting smokeless fuel in 6 minutes.

The lighter and others using the same principle will be going into general production shortly and will be available for purchase.

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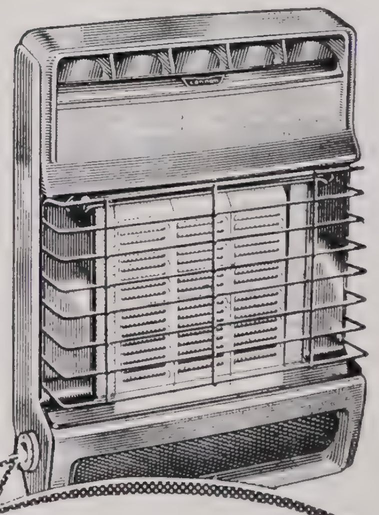

With the development of the Multyjet Convector and the GasMinder Automatic Room Heat Control, Cannon have made continuous room heating by gas a thoroughly economical proposition. More than that, the GasMiser is designed to match modern trends, is colourful, and clean in design as well as in operation. Here is a definite contribution to Clean Air—and to contemporary comfort.

with the **'GasMinder'** *thermostat control for first-rate economy*

For further details write to :—
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DEEPFIELDS · BILSTON · STAFFS.

Stationers' Plight

The journal *British Stationer* recently published three pleas to manufacturers about their products. The first was to diary publishers: "Will you *please* desist from binding pocket diaries in white material. In the polluted, dust-ridden atmosphere in which we have to trade these white items soil within 48 hours of being on display, whereon we are always expected to knock something off the price!" *Verb sap!*

Lord Tedder on Diesel Smoke

Speaking at the annual dinner of the Institute of Road Transport Engineers in London last November, Lord Tedder, chairman of the Standard Motor Company said: "It seems a crazy situation which sees us, for every step forward in clearing the air of coal dust and smog, sliding back towards asphyxiation from exhaust fumes." He went on to say that ease of maintenance had been regarded as a by-product of good design—instead of being one of its key objects.

Tax on Air Pollution

A novel principle for reducing air pollution is reported from Los Angeles. The City Council has been considering a suggestion that motorists should be taxed according to the amount of air-polluting elements which come from their exhausts. They would pay a 10 per cent. tax on all petrol purchased and receive a receipt to present at "smog testing stations." They would receive a rebate in proportion to the amount of pollution caused by the car exhaust, and would get none at all if this reached a certain limit.

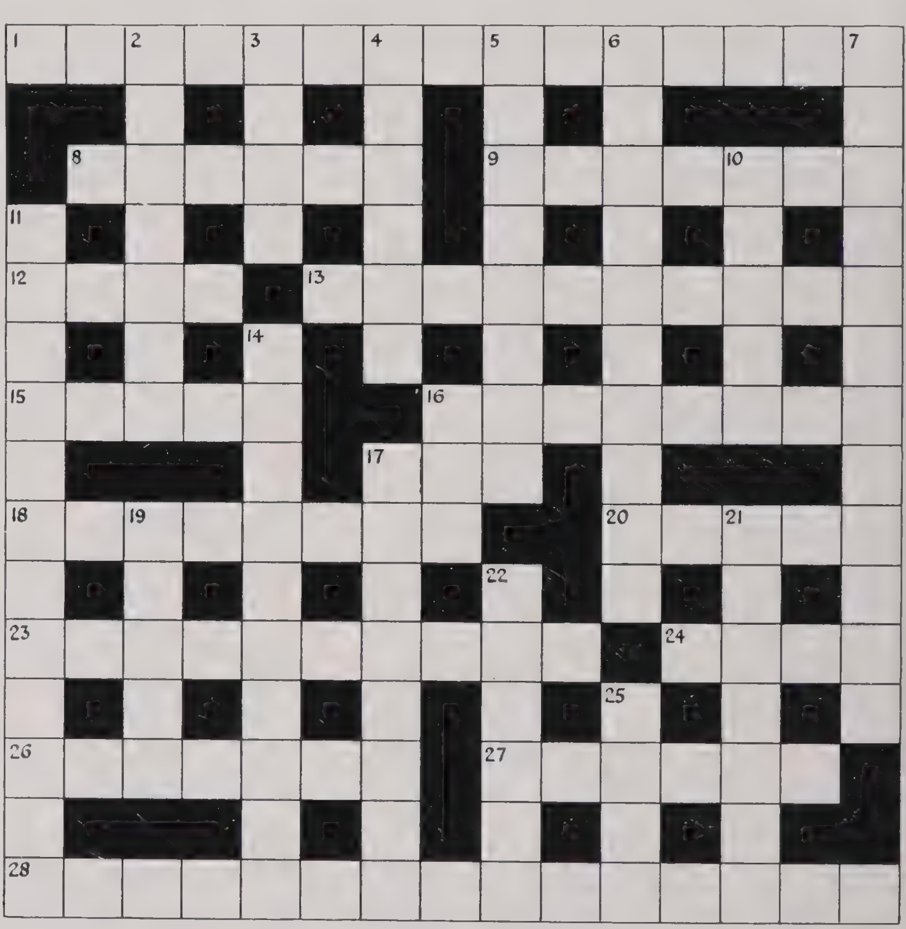
Smoke Control Area Survey Reveals Human Problems

Officials working on the creation of Sheffield's first smoke control area, have come across many lonely old people who are unaware of the services available to make their lives easier. In some cases the officials called in the Home Help Service and in others they put the old people in touch with appropriate associations to help them.

The new Mobile Exhibition van of the Solid Smokeless Fuels Federation

CLEAN AIR CROSSWORD

We present the first Crossword to be published in this journal. It has been set by a reader and will be found to have many references to air pollution. Sorry, but no prizes are offered for correct solutions. Whether it is the first of a regular series of Crosswords depends on our readers, whose views we shall be glad to have.



Set by John Royle

ACROSS

1. Starve Bram—it helps to reduce smoke (9, 6)
8. Season associated with 22 down at the DSIR (6)
9. Heavenly light apparently produced by a bass (3-4)
12. "Love in a –" by Kenneth Horne (4)
13. Reduce smoking found in cigarettes (3, 7)
15. Vessel lodged in the market chimney (5)
16. The first thing NSCA stands for (8)
17. Simpleton, initially, studies atmospheric pollution (3)
18. Such transparency, the 'tecs can be seen inside (8)
20. Twice nightly the tribe's inside (5)
23. A rain stain which some of us may see every month (10)
24. Name the end of anthracite (4)
26. Re-heats in some way and yet is still wood (3, 4)
27. Take a note of the explosion (6)
28. Form of charming lantern mentioned in the Clean Air Act (10, 5)

DOWN

2. Something on account to go with a gauge (7)
3. Somerset Maugham's air washer (4)
4. Shells burst in this often (3, 3)
5. Put darts in this order to annoy the housewife, though it may please us (4, 4)
6. Producing darkness—after nine to start with (10)
7. War returning, the company (nearly all) uses the guns—and are recognized by their smoke (3, 4, 5)
10. French lesson (5)
11. Our title sounds like good advice to our next of kin (9, 3)
14. Offensive colouring to the last one (5, 5)
16. No end to Hogmanay (3)
17. There's an art in steam making Hotspurs for example (4, 4)
19. Shell with honour (5)
21. Tire of the country? The reverse to start with at least (7)
22. Burrow before Spring at the DSIR (6)
25. Heroic poem depicts no drunken fancies (4)

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gives far more pure heat!

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The "TELESMOKE"

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A pocket telescope for checking the density of smoke under the Clean Air Act

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The boiler doesn't smoke

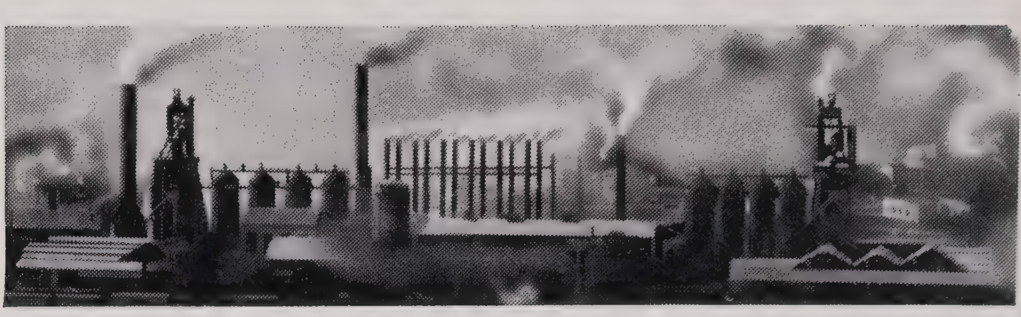
(and the owner doesn't stoke!)

Back in the dark days you stoked the boiler high, and you kept the fire low. But the smoke went up the chimney just the same. You pushed the damper in, and you pulled the damper out. But the smoke went up the chimney just the same. Maddening!

But times change. And so, happily, do boilers. A 'Potterton' Boiler gives central heating *automatically*. The boiler doesn't smoke, and the owner doesn't stoke, because every 'Potterton' Boiler, be it gas-fired or oil-fired, is a model of smokeless, stokeless efficiency.

Fortunately, there's a 'Potterton' Boiler to suit everyone, from the householder to the industrialist. Why not ask the 'Potterton' people for full information and running costs? They'll gladly send them to you—or answer any questions you might have. The address is Thomas Potterton Ltd., 20/30 Buckhold Road, London, S.W.18; the telephone number, VANdyke 7202.

PT 1005



Question which type of dust collection and control plant?

Answer consult Holmes

We have specialised in the design, manufacture and installation of dust collection and control plant for a good many years and today our range is second to none. Plant manufactured by our Gas Cleaning Division includes: Holmes-Elex Electrical Precipitators: Holmes Retroflux and Standard Bag Filters: the Holmes Schneible Multi-Wash System: Holmes-Rothemuhle Multi-Cell Cyclone Dust Collectors and Trion Electronic Air Filters. Enquiries normally entail visits to site by an engineer from our Test and Process Development Section to assess the particular problems involved and their solution in terms of the comprehensive range of plant which is available. Extensive laboratory facilities exist for the examination of dust and fumes, and, where necessary, arrangements can be made for pilot plants to be installed for trial purposes. Detailed technical brochures on all types of plant are available and can be had on request.

W. C. **HOLMES** & CO. LTD.

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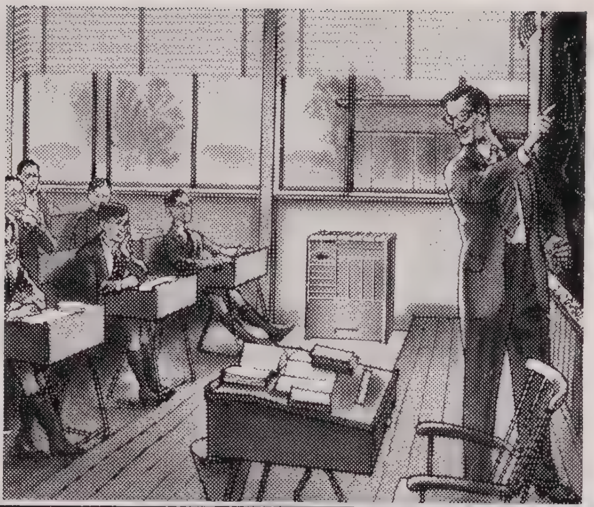
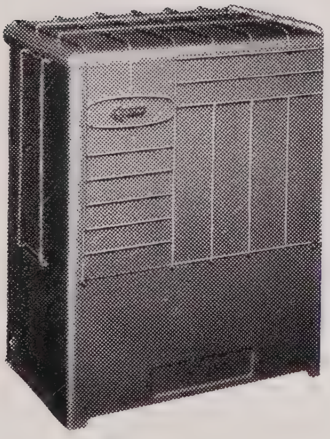


Nightstor Heaters



CUT FUEL COSTS. Nightstor Heaters store heat by night—taking advantage of the cheaper off-peak tariffs available from all Electricity Boards—and dissipate heat by day. Separate thermostatic control ensures that the heaters use only the minimum current necessary to provide a comfortable temperature throughout the following day from first thing in the morning. Thus Nightstor Heaters are not only efficient and clean, they represent maximum economy.

CUT CAPITAL COSTS. Simple and inexpensive to install, without alteration to structures or fittings. Nightstor Heaters are compact units which can be safely placed right up against the wall. Thus using the minimum of floor space.

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Nightstor is a G.E.C. product

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The G.E.C. specialises in industrial heating and manufactures every type of appliance.
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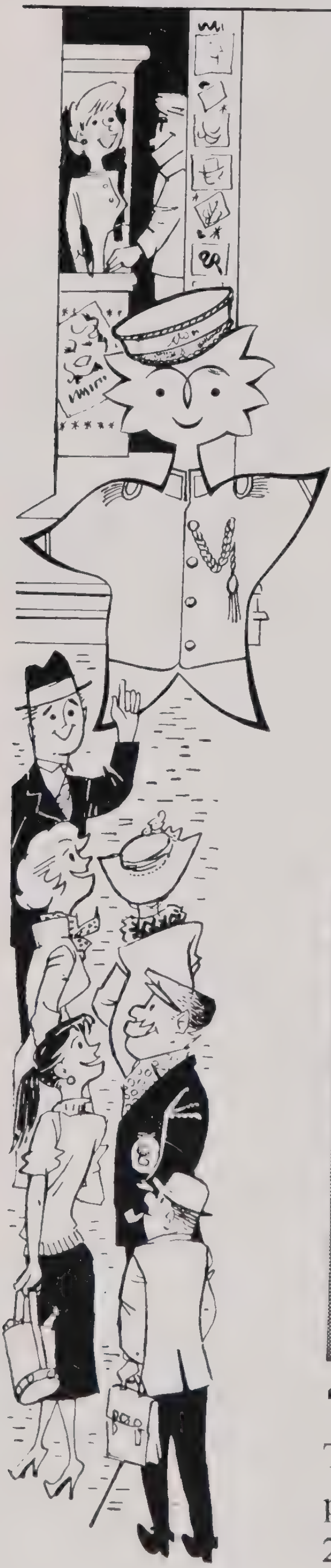

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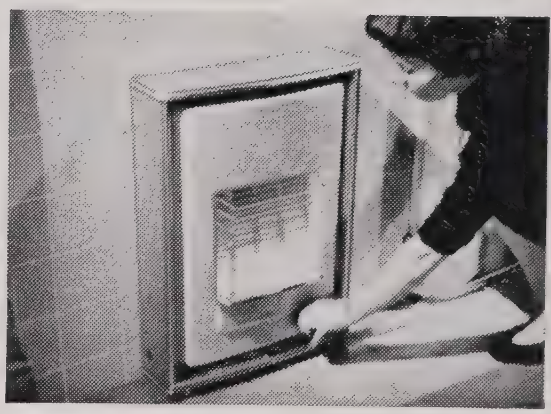

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SMOKE CONTROL AREAS

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is officially approved by The Ministry of Power,
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OVER $\frac{1}{4}$ MILLION BAXI FIRES HAVE BEEN SOLD!

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The under-floor draught of the Baxi Patent Fire enables a bright and cheerful fire to be made with coke.
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to dust extraction
with
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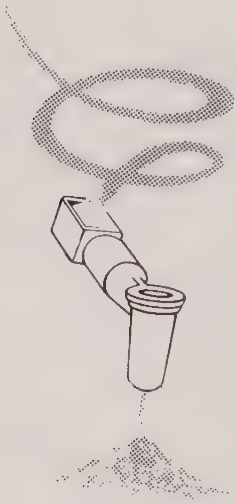
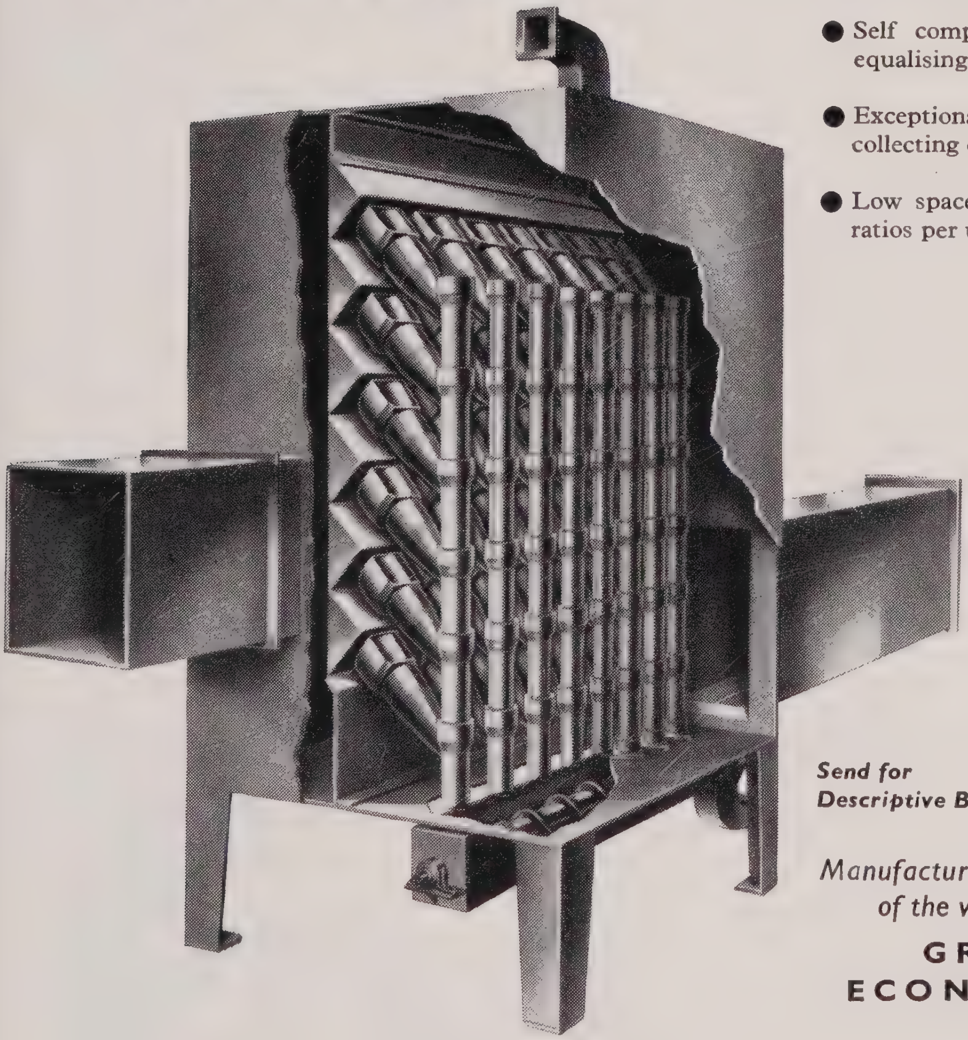
"PARACLONE"
DUST COLLECTOR





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- Self compensating pressure equalising system
- Exceptionally high overall collecting efficiency
- Low space, weight and cost ratios per unit volume

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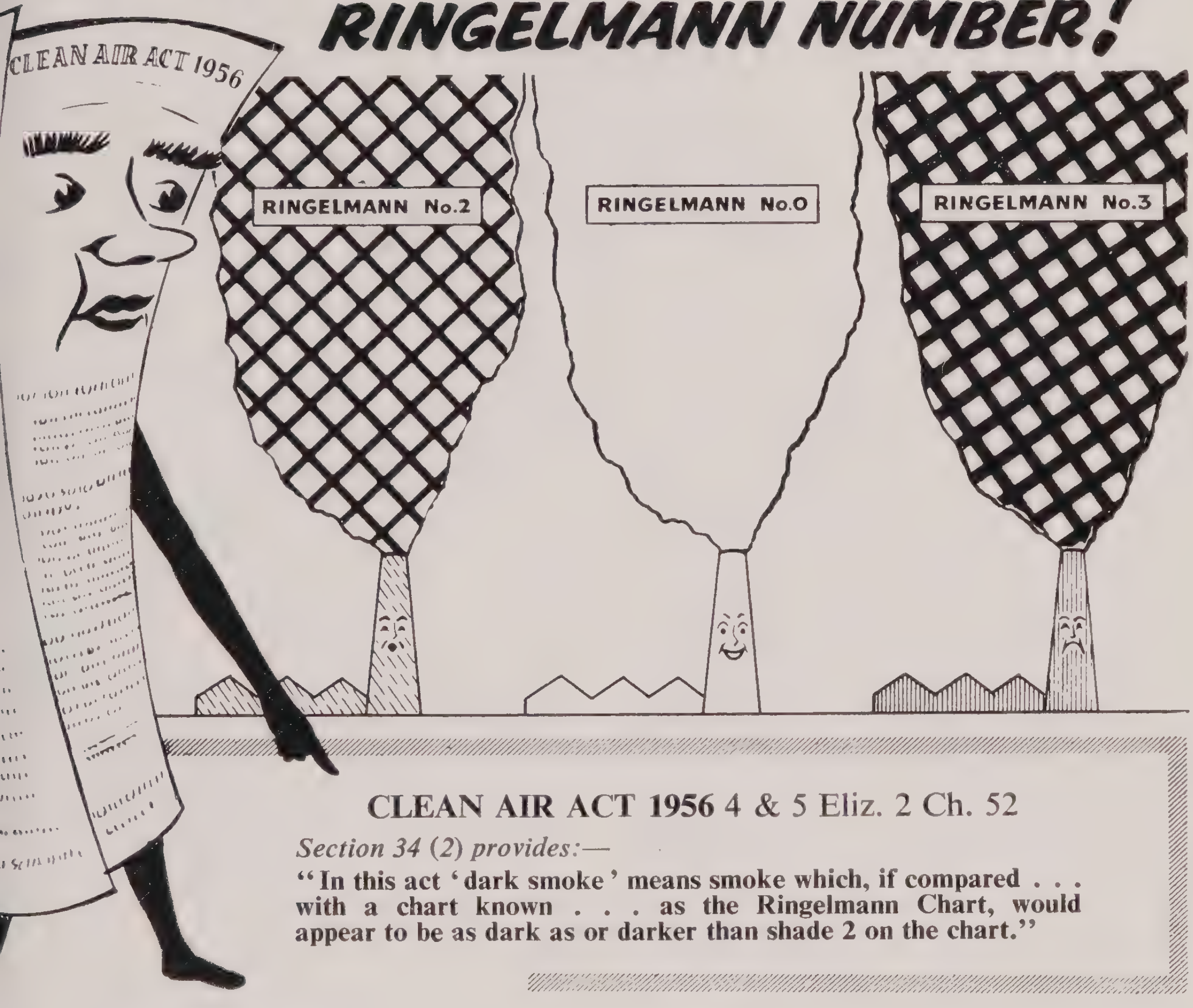

CLEAN AIR ACT 1956 4 & 5 Eliz. 2 Ch. 52

Section 34 (2) provides:—

"In this act 'dark smoke' means smoke which, if compared . . . with a chart known . . . as the Ringelmann Chart, would appear to be as dark as or darker than shade 2 on the chart."

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S A FLAGRANT OFFENCE UNDER THE ACT

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FAILS TO COMPLY WITH THE ACT

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which anticipated the Clean Air Act by 14 years

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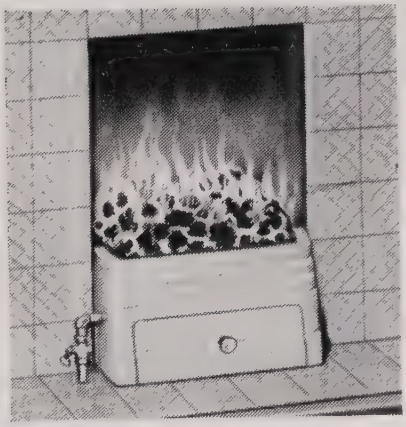
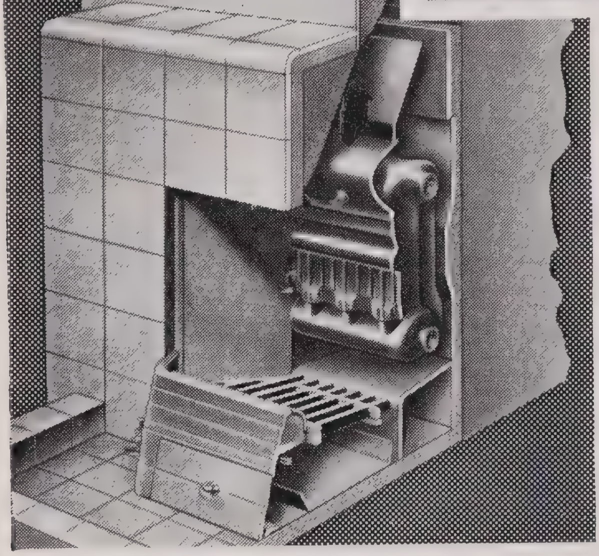
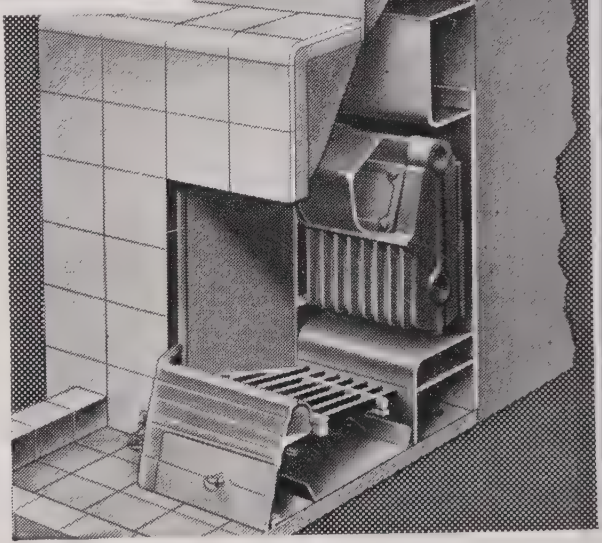


IDEAL NEOFIRE No. 10

British Patent No. 753719





The Ideal No. 2C Neofire is a cheerful open fire, backed by a boiler specially designed to provide the combination of Domestic Hot Water Supply and Background Heating. The boiler will heat up to 3 radiators in other parts of the house, and the domestic supply is obtained by the 'Indirect' method, which entails the installation of an Ideal *Indirect* Cylinder of appropriate capacity.

The Ideal No. 10 Neofire is primarily designed for Direct Hot Water Supply, with a cylinder of not less than 30 gallons. The boiler can be Bower-barffed (rust resistant treatment) for use in soft water districts.

In hard water areas the No. 10 Neofire can be installed to provide both Domestic Hot Water *and* Background Heating.

Each Neofire has a boiler of sufficient power to take care of approximately 40 square feet of radiation, plus an average amount of piping, and to provide hot water for all domestic purposes with a cylinder of 20 gallon nominal capacity. Designed to burn smokeless fuel, Ideal Neofires consume approximately 2 lb. per hour, utilising up to 60 per cent of the heat contained in the fuel, compared with 15-20 per cent by the ordinary open fire.

Standard colours are Cream Mottle, Black, Copper Lustre.

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COAL-Mechanical Stokers and the

CLEAN AIR ACT

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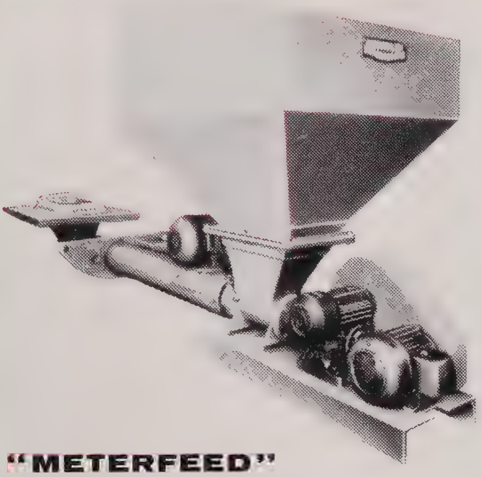

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This stoker has separate drive and fan motors which our "Custodian" Panel controls by cutting in the fan at a predetermined period before the drive and cutting out the fan after the drive has stopped.

The "Meterfeed" Underfeed Stoker is designed for the utmost fuel economy **without smoke** and is available in a full range of sizes in both hopper and bunker feed models and suitable for boiler, kiln and furnace application. All models embody the controlled feed principle.

NEW "CUSTODIAN" CONTROL PANEL

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SMOKELESS AIR

JOURNAL OF THE
NATIONAL SOCIETY FOR CLEAN AIR

FUMUS FUGETUR

No. 114 ⋆ SUMMER 1960 ⋆ 2/-

In this Issue

INTERNATIONAL SECTION ★ NONHEBEL ON CHIMNEY HEIGHTS ★ Public Relations in Smoke Control Areas ★ The Black Areas ★ Industrial Dust Suppression and Collection ★ Solid Smokeless Fuel Committee's Report

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gives far more pure heat!

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(and the owner doesn't stoke!)

Back in the dark days you stoked the boiler high, and you kept the fire low. But the smoke went up the chimney just the same. You pushed the damper in, and you pulled the damper out. But the smoke went up the chimney just the same. Maddening!

But times change. And so, happily, do boilers. A 'Potterton' Boiler gives central heating *automatically*. The boiler doesn't smoke, and the owner doesn't stoke, because every 'Potterton' Boiler, be it gas-fired or oil-fired, is a model of smokeless, stokeless efficiency.

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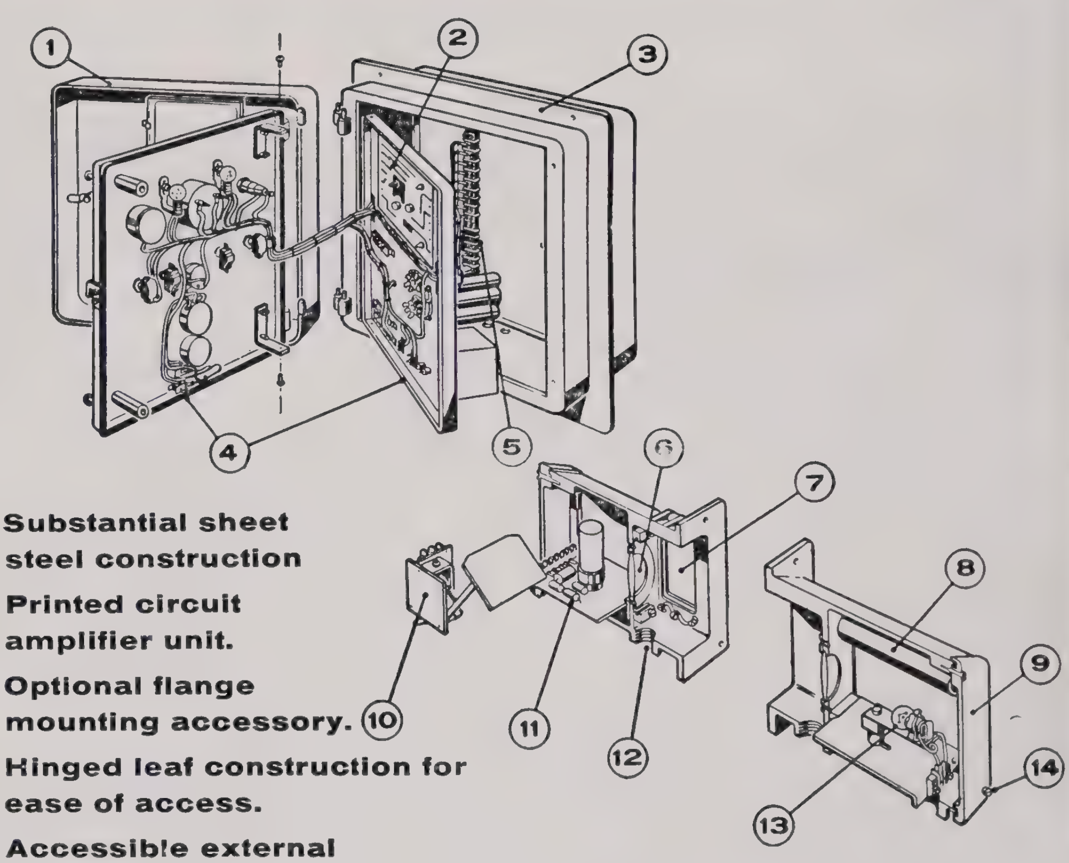
Now—you can ensure*

against clean air act



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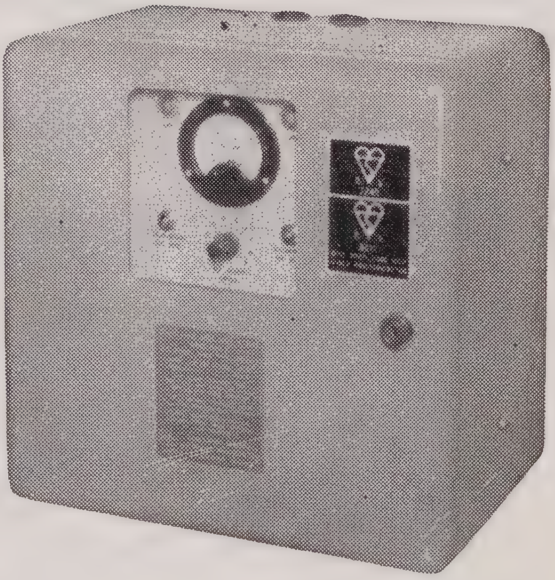
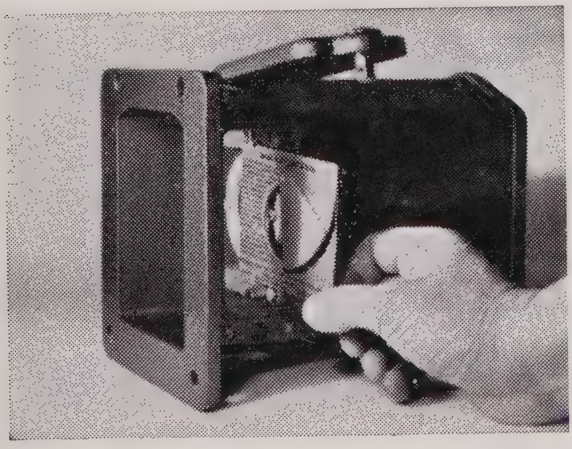
Priced at well under £100 – yet engineered to the highest standards and manufactured and tested to rigorous specifications – the equipment offers a plus – simple conversion to smoke density indication for combustion control and fuel saving.

* This equipment is the first of its kind to carry the British Standards Institution's "Kite Mark", which indicates independent certification of compliance with BS.2740/56 or, plus the appropriate indicating instrument, with BS.2811/57.



Main unit showing locked away controls and calibration meter.



Calibration check by manual insertion of check slide.

PRODUCTS LIMITED

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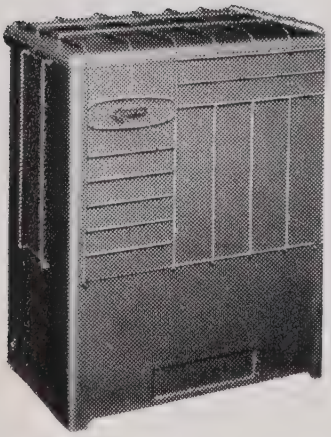
Nightstor Heaters



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Nightstor *is a* G.E.C. product

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The G.E.C. specialises in industrial heating and manufactures every type of appliance.
Make use of our free advisory service without obligation.

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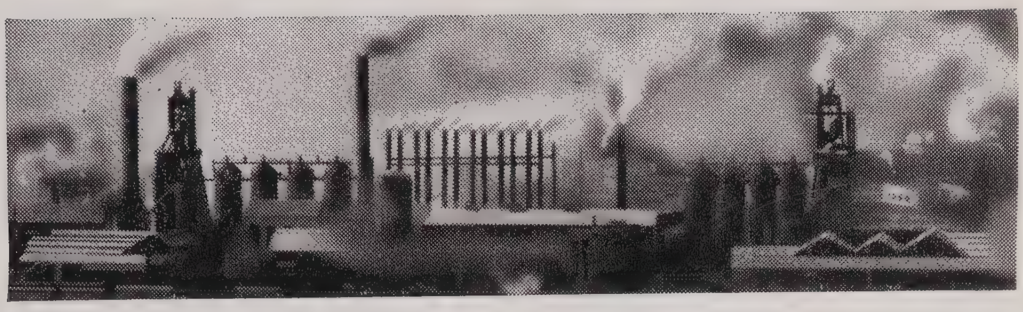

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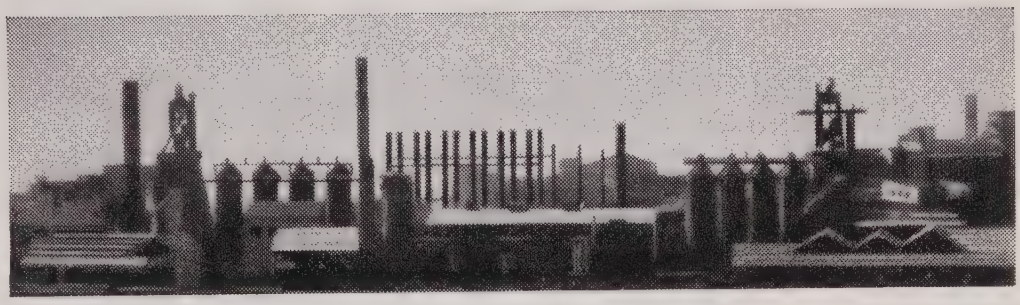

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W. C. **HOLMES** & CO. LTD.

Gas Cleaning Division
Turnbridge, Huddersfield

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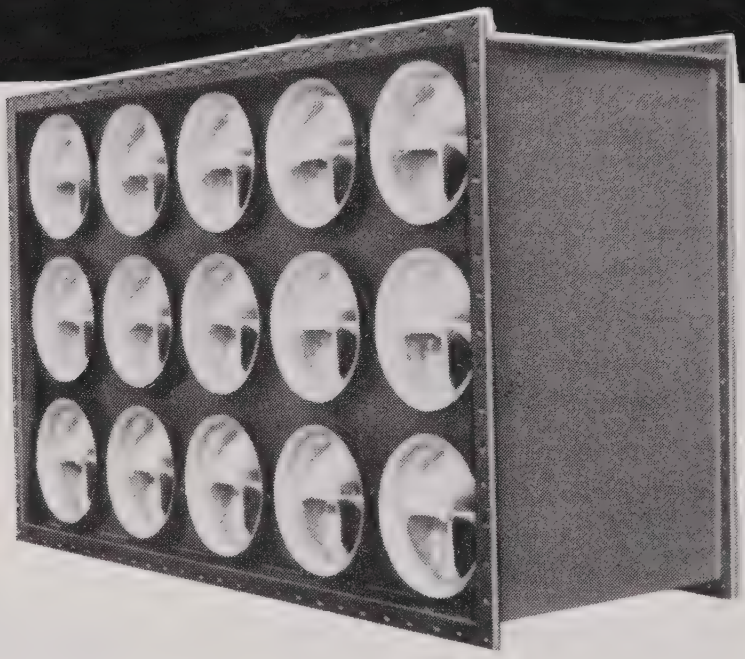

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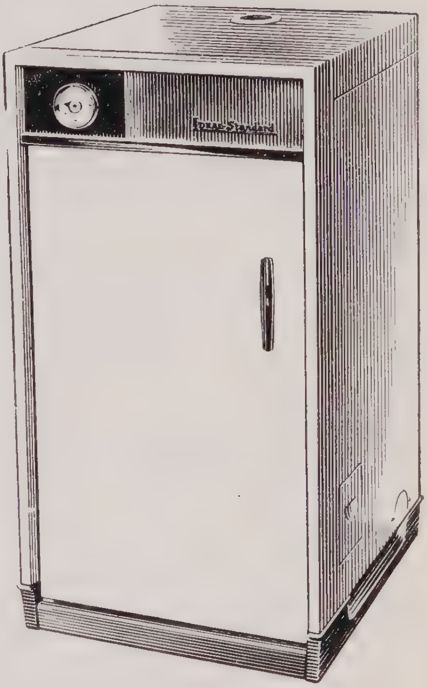

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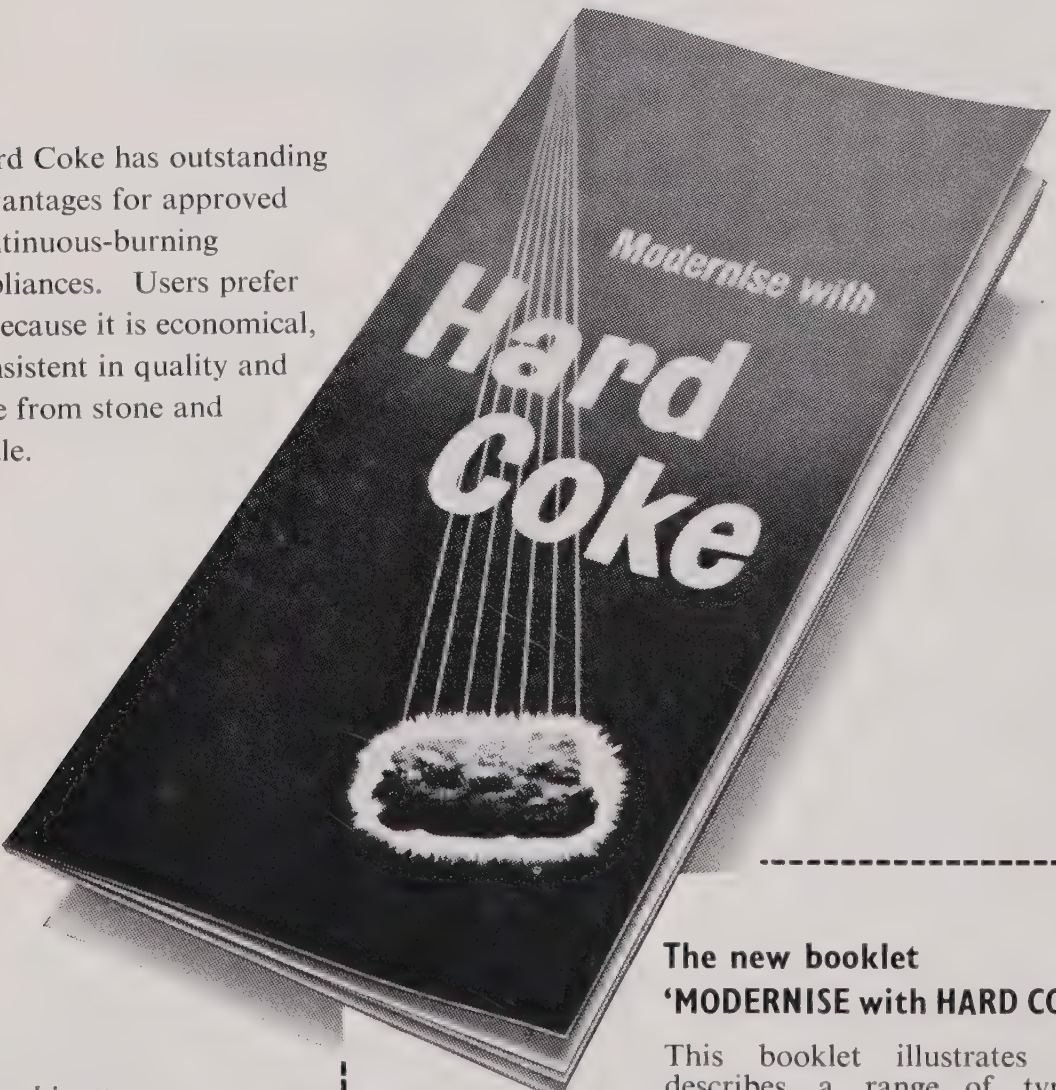

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HEADQUARTERS FUND

All Members and (for information) Representatives will be receiving an Appeal letter asking for donations to assist the Society in moving to and equipping its new headquarters. (See Note on page 256). £4,000 is urgently required. We invite both your own donation and any assistance you can give in securing others. All donations will be acknowledged in "Smokeless Air."

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SMOKELESS AIR

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Ships, towers, domes, theatres and temples lie
Open unto the fields, and to the sky ;
All bright and glittering in the smokeless air.

SMOKELESS AIR

OUR INTERNATIONAL SECTION

SMOKELESS AIR, after over thirty years' publication, begins in this issue an important new phase with the inclusion of an International Section. It is hoped that this will be a notable and regular feature of the journal and that it will help to promote the closer international co-operation that was called for at the Diamond Jubilee conference last October. The possibilities of some form of international association are being considered but even if such a development does in time materialize it will take a considerable time, and there is a need to maintain and develop the international liaison that was started in such a friendly way at the conference.

One of the main purposes in seeking closer co-operation between all the countries concerned with air pollution is the exchange of news and information; to assist each to be kept informed of what others are doing. The best way in which this can be done and made regular is by the printed word, and in *Smokeless Air* we have a medium already in existence that can be used for this purpose. We are glad to be able to devote to it a number of our pages.

We do not claim that this is an ideal arrangement, but it has the merit of being able to start immediately and without the delays and doubts that would be inevitable if organizational and financial schemes had to be considered. And starting in this modest way means that any future growth can be flexible.

Two or three points must be stressed. In the first place, to our members and many other readers in Britain, the International Section does not mean any less attention being given to home news and features, as this issue should show. We have always tried to include overseas contributions and reports and to do this in an improved and more definite way, by widening interest, should add to rather than detract from the journal's original function.

Secondly, we are not seeking to compete with, but to complement, other journals of a more scientific or technical character which, being intended for specialists, naturally have a less general interest. We hope in the International Section to keep the same broad interests and balance that has been our aim throughout—certainly technical and scientific material of importance; legal, parliamentary and administrative reports; industrial and commercial progress that is helping clean air; air pollution news of every kind; comment, discussion and photographs. *Smokeless Air* set out to interest, keep well-informed and encourage *all* who are (or should be) concerned with clean air, and we hope now to serve our overseas friends in the same way.

Thirdly, we are not seeking to keep to ourselves what may be published. Subject to the approval of any author concerned, we welcome the re-publication or quotation of our contents in other journals, and are happy to publish material that may have already appeared elsewhere but which is not likely to have been read by most of our readers. To disseminate information that will help to promote clean air is one of the functions of the N.S.C.A. and its journal is simply a means to that end.

The International Section is prefaced by a first list of overseas friends who have kindly agreed to act as our Honorary Correspondents. We hope to extend this list as time goes on, and because of the diversity of aspects of the problem there is no thought of having one correspondent only in any country. We do not expect to cover every country in each issue but we do hope that the news and other contributions in each issue will provide a truly representative picture of what is happening over the world in general.

We are well aware that, to begin with, this new section will be read more by our British readers than by those overseas, but we hope that our circulation abroad will steadily grow. If it does then the time might come for the International Section to be issued separately, perhaps with its more important contents, or summaries of them, in other languages. That, however, is looking rather too far ahead.

A New H.Q.

The Society is moving into new offices in the near future. For some time now the expansion of our work, including a greater coming and going of exhibition and other publicity material, has led to congestion and inconveniences in our present rooms in Bridge Street. It has not been easy to find suitable premises in London at a rent the Society can afford, and the idea of moving out of the more expensive central area, though it has attractions, has had to be turned down because of greater disadvantages. At last, however, offices which come near to what we require have been found and secured. They are in Field House, Bream's Buildings, off Chancery Lane. (Bream's Buildings, oddly, is the street name). They have the advantages of more floor space, being on the ground floor, providing a committee room, and generally lending themselves to the better planning of the Society's staff arrangements.

The move, and why it is necessary, was reported to the recent A.G.M., when there was a firm demand by members that the not inconsiderable costs should be met by a special appeal for donations. To cover the sum required—£4,000 in all—out of ordinary income would mean cuts in activities, while to do so by selling out our slender reserves would be equally unfortunate. A " Headquarters Fund " Appeal is therefore being launched and all members and their representatives will be receiving a request for their support. If every member would make a donation equal to one-half (or more) of their normal annual subscription the sum required would be secured. It is not a vast sum to ask for compared with the value of the work to be done but it will mean a great deal to the Society over the next few years.

What is a Black Area?

This is the title of a leading article that appeared in the April 9th issue of *The Coal Merchant and Shipper*, which is the official organ of the coal distribution trade. The main theme is that the trade is being unjustly accused of opposing smoke control: " Coal distributors," it said, " are subject to the most bitter attacks on the alleged grounds that they are setting out to oppose the Clean Air Act, despite the fact that they have made it perfectly clear that it is not their intention to object to the setting-up of smoke control areas in heavily polluted areas."

The facts can be stated quite simply. To our own knowledge—which may not be complete—*out of* 41 *cases of opposition promoted by the coal merchants to smoke control area proposals, not less than* 28 *were in towns within the black areas*, as listed last year by the Ministry of Housing and Local Government. (See *Smokeless Air*, No. 110, Summer, 1959). They included such towns as Birkenhead, Bootle, Bradford, Bristol, Halifax, Preston, St. Helens, Stretford and West Bromwich!

The Case for Coal

After this regrettable business of the coal merchants, which we are not alone in regarding as a disservice to the long-term interests of coal, it is a pleasure to draw attention to a first-class booklet, *The Case for Coal*, issued by the National Coal Board and addressed to such people as industrialists, architects, local authorities and hospital management boards. In a most attractive and informative way it explains and illustrates the modern ways of using coal, and deals fairly and helpfully with the need to burn it—or its derivatives—smokelessly under the Clean Air Act. Descriptions and colour diagrams of the different types of mechanical stokers will be found helpful to many.

The booklet is part of the drive being made by the Coal Board, another part of which is the campaign for central heating with solid fuel, to challenge the publicity of the oil interests. This competition is to be welcomed by the clean air movement because it all helps to promote the more efficient and therefore more smokeless use of one kind of fuel or the other. From our viewpoint, coal burned smokelessly is as good as oil burned smokelessly, and we can stand on the touch line and cheer both sides. Our oil friends have perhaps gained a psychological lead in their widely-advertised appeal to " Mrs. 1970 " and we are glad that the N.C.B. is also looking ahead and not leaving the case for coal to those who seem to be so emotionally attached to " Mrs. 1870."

The Year Book

The Society's *Clean Air Year Book* for 1960 has now been published and a copy will have reached all members. Other readers may obtain one at 2s. each, plus 4d. postage. It is again a useful, compact and thoroughly revised reference work for all aspects of work on air pollution, including the legal, administrative, technical, statistical and bibliographical. One interesting feature is the latest estimate of the quantities of pollution from different sources, revised up-to-date from the table that appeared in the Beaver Report by Dr. A. Parker, former Director of the Fuel Research Station. Taking into account reductions in industrial smoke and the new evaluation of smoke produced from the open coal fire, we see that there are 1·1 million tons of domestic smoke compared with 0·5 million from industry and 0·1 million from the railways. On the other hand domestic chimneys contribute only 100,000 tons of the total of 900,000, and nearly one million of the 5·6 million tons of sulphur dioxide.

The useful directory of organizations that have air pollution interests is for the first time divided into British and overseas sections—the latter made possible by the enlargement of the Society's information as a result of the International Conference.

The International Conference Proceedings

The preparation of the *Proceedings* of the Diamond Jubilee Conference are making good progress and the volume should be published within the next few weeks. Containing 78 papers, the Rapporteur's reviews, discussions and authors' replies, the volume will be substantial and, taking into account the wide scope of its contents, we think it will be recognized as one of the most important air pollution reports ever to be issued. Each copy will be bound in full cloth, with dust jacket and cardboard case for posting. We have been receiving some anxious inquiries about the date of publication and hope it will be appreciated that such a work does take time, especially when so many contributors are so far afield and when staff to work on it is so limited. Knowing the time taken by other organizations to produce similar conference publications we think that we are in fact progressing pretty well.

THREE LOCAL AUTHORITIES TAKE OVER CONTROL POWERS FROM ALKALI INSPECTORATE

Six Applications Refused

Mr. Henry Brooke, Minister of Housing and Local Government, has made orders transferring to the local authorities concerned the control of smoke, grit and dust from certain industrial processes in Liverpool, Manchester and the Sheffield area. Control hitherto exercised by the Minister's Alkali Inspectors in respect of these particular processes will in future rest with the City Councils of Liverpool and Manchester and with the Sheffield and District Clean Air Committee.

The orders came into effect on May 23rd. They transfer control over smoke, grit and dust from Clarence Dock and Lister Drive power stations to the Liverpool City Council, and from Stuart Street power station and the producer gas plant at the Openshaw works to the Manchester City Council. A further order transfers to the Sheffield and District Clean Air Committee control over smoke, grit and dust from air and rotary furnaces for iron and steel, electricity works, producer gas works, certain ceramic works and (in view of the constituent local authorities' long and close association with the steel industry) electric arc furnaces up to 30 tons' capacity and tropaenas. Among the processes the Minister has decided to exclude from the orders are gas and coke works, blast furnaces and open hearth furnaces.

The Minister has decided to refuse applications made by six other local authorities (Reading and West Bromwich County Borough Councils and Jarrow, Luton, Redcar and Stalybridge Borough Councils) for transfer in respect of certain processes. No other applications have been made.

Under the Alkali, &c. Works Regulation Act, 1906, air pollution from a wide variety of industrial processes is controlled by the Minister's Alkali Inspectors. The processes registered for this purpose are in the main those giving rise to pollution problems which are unusually serious, or the prevention of which is technically difficult. The Clean Air Act, 1956, which among other things gave local authorities powers to deal with industrial smoke, grit and dust generally, placed on the Alkali Inspectorate the responsibility for dealing with smoke, grit and dust from processes registered under the Alkali Act. But it gave the Minister power to make orders which have the effect of transferring this responsibility to local authorities (or, as in the case of the Sheffield and District Clean Air Committee to a joint committee of local authorities to which powers have been delegated by the constituent authorities).

The Minister takes the view that the transfer of control should at present be limited to the largest local authorities, employing experienced staff with the appropriate qualifications. Where control is transferred, he thinks that it should usually be limited to smoke, grit and dust from processes involving fuel combustion, and should only exceptionally include processes involving problems of chemical engineering.

The Alkali Inspectorate will keep in close touch with the officers of the Liverpool and Manchester City Councils and of the Sheffield and District Clean Air Committee, so as to ensure that they are aware of technological developments and of the standards required by the Inspectorate elsewhere.

Public Relations in Smoke Control Areas

Society's May Meeting in London

THE Annual General Meeting of the Society was held in London on May 17th, 1960, and was attended by about 200 members and representatives. At the close of the formal business the meeting was briefly addressed by the President, Sir Hugh Beaver, who referred to the growing influence of the Society and the need for the continuation and expansion of its work in the coming years.

Mr. John Innes, Chairman of the Council, presided at this meeting, and on behalf of all present he conveyed to Sir Hugh their delight at his presence and his recovery from the illness that had so unfortunately kept him from the International Conference.

In the afternoon, with Dr. J. L. Burn in the Chair, there was an open discussion meeting on the subject of "Public Relations in the Promotion of Smoke Control Areas." Six speakers, from different Divisions of the Society, opened the discussion with short addresses.

Dr. Burn in his opening remarks reminded the meeting how Charles Gandy had sounded the cry of smokeless zones in Manchester twenty-five years ago. He said that many of those interested in clean air had had an ideal of 100 per cent smokelessness in mind, but it was clear that in black areas they must and would be content with a smokelessness of 80–90 per cent.

Dr. Burn wondered why so few women took an interest in the Society, considering the way in which the dirt of air pollution affected their daily work.

He also laid emphasis on the misery caused by the effects of air pollution on health.

Dr. Burn then introduced Dr. Burnett, Medical Officer of Health of Preston and a Past Chairman of the Society.

Dr. Burnett said that reactions to the establishment of smoke control areas had been very varied. Evidences of active opposition were not in themselves important, but what was important was the disturbance to the affected householders. It took time to kill the mass of misinformation and misrepresentation that had been scattered about and to restore goodwill.

Apathy usually meant that a fair proportion of householders did not bother to convert; although superficially this meant less work it stored up trouble from dissatisfied householders. People had to be coaxed out of their apathy and shielded from misrepresentation by those aims which were governed by personal gain.

There were five factors, Dr. Burnett said, which should be taken into account in building up good relations. First, national factors such as effects on health should be related to the individual in his own locality. Care should be taken to stick to the facts.

Second, the Clean Air Act is supported by all political parties and good use could be made by quoting statements made by both main parties.

Third, personal advantages were the thing that interested most householders.

Fourth, it was necessary to deal with other sources of local pollution and to let the public know this was being done.

Fifth, damaging statements should be challenged and the Society was able to help with information for this purpose.

Dr. Burnett ended by saying that sincerity was the most important factor and would pay in the long run.

Dr. Burnett was followed by Mr. Herrick, Chief Public Health Inspector of Fulham, who described the policy followed by his Council in their successful programme. He said that it was appreciated from the outset that the public demand for smokeless forms of domestic heating was expanding naturally and that the creation of smoke control areas merely accelerated an existing trend; that all affected by the Council's proposed Orders have the right to the fullest information; that it would assist the Council to be aware of any objections and doubts at an early stage. Experience had shown that individual objections and doubts were easily resolved; that the concentration of publicity, area by area, helped to avoid confusion; that the focal point of public relations activities should be the householder (the potential offender); and that some publicity media had been particularly successful, e.g. the local Press, talks given to local organizations especially old people's clubs and small localized exhibitions.

Mr. G. Hopper, Senior District Public Health Inspector of Bristol, said that it should not be forgotten that the public does not unanimously accept Smoke Control Areas; public relations should be carefully built up and nurtured; there should be no forcing the public along.

The public should be prepared before smoke control procedure is even considered; smoke control should not be sprung upon the public suddenly.

No opportunity for publicizing air pollution matters should be missed.

Possible and probable objections should be anticipated and early approach made to the sources of such objection.

Mr. L. Mair, Chief Public Health Inspector, Newcastle-upon-Tyne, in his contribution, said that general publicity—contributed articles in local press, exhibitions, talks to women's guilds, etc., had a certain limited value in establishing good relations with the public. Maximum interest of public could not be aroused unless a definite programme of action had been formulated which would give some firm indication as to how and when particular residents would be affected. Much more effective publicity was found—

After announcement of decision in principle and during survey local press enthusiastically lent support when plans of proposed areas, statistics of numbers and classes of premises together with costs were available—all front page material and very effective. At same time, television and sound radio news interviews had been most effective—timing is important. Always state where further information could be obtained and invite residents in proposed areas to seek advice.

In general it was essential to keep public informed of intentions and progress. A planned smoke control area programme was also essential, otherwise publicity and exhibitions, etc. were a waste of time. Courtesy and helpfulness between Health Department and public (from housewife to company chairman) were an imperative necessity at all times.

Mr. Mair said that his personal view was that relations between council and public were not responsible for slow progress of smoke control areas. It was mainly due to apathy of local authorities to take any action other than exhibitions, etc., without follow up. This was possibly the result of the concessionary coal problem, expense and protracted time-consuming procedure.

Finally, public relations were important at all times but it was more important to have a programme of action and cultivate public relations to suit the programme, than to formulate a programme to fit public relations; if this were not borne in mind no effective progress would be made in mining communities.

Mr. J. W. Batey, Chief Smoke Inspector, Sheffield, emphasized that full-time staff must be employed on all the detailed work in connection with the formation of Smoke Control

Areas. No worthwhile results would be obtained by using, for example, young men who were training to be Public Health Inspectors. Such full-time staff must be capable of dealing with all aspects of the work.

The other major point he made was that the general public should not be required to fill up any form whatever and that merchants who were interested in conversion work need not be asked to follow any special pattern. The only thing required from merchants was an estimate for the work to be done.

The last speaker in the symposium was Mr. W. Parker, Chief Public Health Inspector, Dudley. Mr. Parker told of the actual experience of his Authority and his three stage pattern of approach to the creation of smoke control areas. In addition to general publicity and a careful approach to householders in a proposed smoke control area, there was also an " After Sales Service," in which each householder was revisited and given any necessary assistance with difficulties encountered when using smokeless fuel. Mr. Parker concluded by saying: " Time is of the essence when dealing with smoke control areas. It is not a question of minimum time, but one of sufficient time to make, as sure as possible, for the success of the undertaking. One failure is one too many. One success is not enough.

Smoke control now is affecting the individual householder. The Authority and its officers must be prepared to deal with individuals. There must also be a readiness to put out " follow-up " publicity. This has been done by talks to Rotary and other organizations—window displays—articles in the press and participation whenever possible, in exhibitions.

Precept is also of the utmost value, and the whole of my staff have practised good example from choice and not of necessity. It is nice to be able to say " Go and do likewise."

Discussion

The discussion which followed was opened by Mr. St. John Rowntree, Health Education Officer of Sheffield Corporation. Mr. Rowntree said that too much emphasis was placed on information rather than relations with people. An endeavour should be made to create a sense of personal involvement. The emphasis should be on personal rather than public relations. General public relations programmes should be conducted nationally, locally, and also directed towards local councillors and the District Auditor.

It was a good thing to direct efforts towards the education of the children, who would soon be taking their places as householders.

Mr. Rowntree also felt that it was essential to keep the same people on interviewing and other smoke control area work, throughout the whole programme, so that they became thoroughly familiar with the work, and the public with them. It was vitally necessary to be prepared to spend a fair amount of money on public relations.

Miss Boyd, Individual Member, expressed support for the idea of grants for conversions on a voluntary basis, before the creation of smoke control areas.

Mr. A. C. Hazel (Hurseal Ltd.), pointed out that in order to convince it was only necessary to know the subject and tell the truth. Smokeless fuels were not expensive when used in a proper appliance. It could also be pointed out to the public that in Britain heating formed a smaller part of family expenditure than in any European country except Spain and Italy.

Mr. Stanley Cayton, Chief Public Health Inspector, West Bromwich, said that in their earlier smoke control area they had not left any written material with householders, and this was a mistake.

However, when visiting householders after the area had been in operation for some time, they were amazed at the amount of satisfaction with smokeless fuels expressed by householders. He felt that once an area had been created it was best to leave people to work out their own salvation for a while and get on with a new area. A successful area was the best recommendation for new areas.

In many houses equipped with the latest devices the heating was still the same as it had been for many years but this position was now changing and a great deal of interest was being taken in whole house warming.

Councillor A. E. C. Tudball, of Bristol, said that there was a tendency to neglect Council house tenants; 90 per cent of tenants were sticking to coal and the economics of smokeless fuel should be got over to them. Councils should also give more thought to enabling tenants to use alternative fuels.

Councillor C. A. Watson of Scunthorpe complained that public relations were not assisted by the long delay by the Ministry in giving a decision after public inquiries. Results had still not been given after three months.

Mr. S. C. Beaumont, Chief Public Health Inspector, Birmingham, said that owing to the large immigrant population in Birmingham, it had been necessary to publish literature in four languages.

The discussion was closed by Alderman W. L. Dingley, of the Warwickshire Clean Air Council, who said that the best aid to public relations was the satisfied customer.

The Chairman then asked the principal speakers to reply to the discussion.

Mr. Parker said that control over industrial pollution should go hand in hand with, if not precede, the introduction of smoke control areas. He thought that the point made by Miss Boyd was a good one.

Mr. Mair said in answer to Mr. Rowntree that there was some difficulty in getting the miner to accept wholeheartedly the idea of smoke control areas. Mr. Herrick said that while he agreed that there were special difficulties in an area such as Mr. Mair's, he could see no real reason why London and the Home Counties should not be smokeless by 1965.

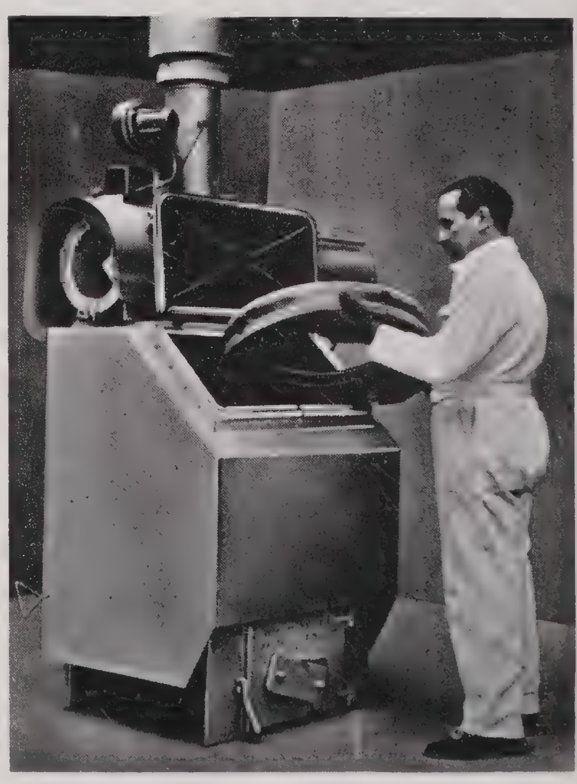
The meeting closed with a vote of thanks to the Chairman and speakers from Mr. John Innes, Chairman of the Society.

THE HOSKINSON INCINERATOR

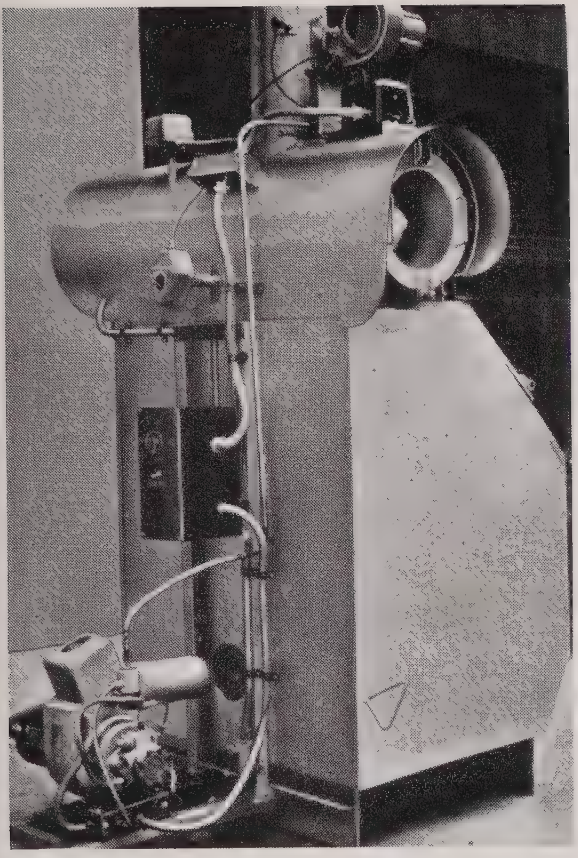
A very frequent and often difficult smoke or fume nuisance is that caused by the incomplete incineration of waste materials of all kinds and there is a need for equipment that can ensure the destruction of such waste without nuisance. An interesting development in this field is the Hoskinson Space-Heating Multi-Fuel Incinerator, which was recently demonstrated, most convincingly, in London.

An American invention, it is being placed on the British market by the Boston Marine and General Engineering Co. Ltd. (Heath Town Works, Dean's Road, Wolverhampton). As the name implies it is a dual purpose unit, which gives not only smokeless incineration but can supply heat to all types of industrial and commercial premises.

The accompanying photographs give a general idea of the appliance. At the base of the chimney is mounted a small oil burner, consuming approximately a half-gallon per hour, and a forced draught fan. The air from the fan



The Incinerator—taking a rubber tyre



The Incinerator from the rear, showing smoke-burning chamber and automatic oil-burner

passes through a special diffuser and supports the combustion of the ignition oil flame and air to mix with the smoke from the material being incinerated, which burns continuously within the inner stack. The chimney is designed as a carburettor and consists essentially of two concentric cylinders. Air passes into the annular space and by thermo-cycle passes upwards, where it enters the chimney. This highly preheated air then mixes with the remainder of the smoke and complete combustion of the gases is assured.

Space heating is achieved by a high-powered fan blowing air through the heat exchanger. The gases from the furnace pass through the inner space imparting their heat to the air before passing into the chimney and the smoke eliminating chamber. Cleaning is simple and takes not more than three to four minutes.

Normal cast iron would not withstand the operating temperatures and the specification includes a nickel-chrome content in all cast iron parts. The additive lifts the burning temperature of the cast iron and ensures a long life for the incinerator furnace. The rate of firing is up to 300 lb. per hour and large rubbish is easily admitted through the furnace door, which measures 29 by 15 inches.

In order to maintain heat when the available rubbish has been consumed the heater is fitted with an automatic oil burner. This is mounted on slide rails at the rear of the furnace and when pushed into the operating position automatically changes the electrical circuit to automatic oil-fired space heating. Room thermostats may be fitted where desired. When rubbish is available the oil burner is withdrawn on its rails and the heater changes over to automatic smoke elimination, bringing the chimney burner into operation.

Both oil burners have flame failure protection and automatic ignition, operated from a common control panel. The oil supply valve operates instantaneously as the burner is withdrawn, transferring the oil supply from the furnace to the chimney burner. The changeover from rubbish to oil takes only a few minutes, whilst the furnace residue is cleaned out and the oil burner is slid into position. This aspect of the unit is extremely important where rubbish supplies are intermittent or when space heating is required to be automatic before the work people are at the premises.

Newcastle's Smoke Plumes

A fresh viewpoint on Tyneside's air pollution problem comes from cadets of the Durham University Air Squadron, whose scarlet and silver Chipmunk training planes are a familiar sight overhead west of the city.

The student pilots say that the blanket of smoke covering Newcastle is particularly noticeable from a bird's eye view, and that trails of smoke from factory chimneys, which seem from the ground to disperse after a few yards, are in fact traceable for many miles from the air.—*Newcastle Evening Chronicle*, 31*st March*, 1960.

INTERNATIONAL SECTION

First List of Correspondents · Damage to Forests New Law for California

Preliminary

An editorial note on an earlier page explains the purposes of this new International Section of the journal. Although there has been insufficient time to make all the links we hope for, or to gather in very much material, we are able to make an interesting beginning and to give a first list of friends overseas who have agreed to act as Honorary Correspondents.

They are: Dr. W. Lindberg (Norway); Dr. H. Kirste and W. Hansem (W. Germany); Dott. Ing. E. de Fraja Frangipane and Professor B. Paccagnella (Italy); Ralph C. Graber and Arthur C. Stern (U.S.A.); W. Cronin and F. E. Dawson (Eire); Y. Queret and Dr. A. P. Avy (France); Professor Dr. J. W. Tesch (Netherlands); J. Delcroix (Belgium); and Dr. J. Kepski (Poland).

CONFERENCE ON AIR POLLUTION DAMAGE TO FOREST TREES

From Dr. Hanns Kirste (Bochum)

Atmospheric pollution is not only a danger to public health but in some ways even more for vegetation. As a result of the longer growth process forestry seems to be threatened more than agriculture and horticulture.

Smoke damage started very soon after the beginning of industrialization, that is to say 120 years ago. Now there are a considerable number of scientists and experts of different branches who are engaged in research on smoke damage to coniferous and deciduous forests.

With a view to exchanging experience and knowledge, the "Landesanstalt für Bodennutzungsschutz des Landes Nordheim-Westfalen" in Bochum invited experts of forest smoke damage to a meeting held in Bochum from October 6th to 8th. This was the second congress of its kind after the war, and was held only a few days before the great International Clean Air Conference in London. More than thirty scientists accepted the invitation, coming from Austria, Czechoslovakia, both parts of Germany, and the Netherlands, so that they represented the middle of Europe. (I am sorry not to have known at that time my present friends in England. Next time I will of course let you have an invitation as well!)

The preparation, performance and organization of the meeting was largely due to Dr. Wentzel, who is an expert in forestry of the Landesanstalt. He is well known among experts on account of his research into the damaged woodlands of the Rheinisch-Westfalisch industrial area.

The first day's programme consisted of reports which were discussed under the chairmanship in the morning of Prof. Dr. Huber (Munich), and in the afternoon of Dr. E. Zieger, Director of the Institut für Forstschutz (Dresden-Tharandt).

Reports on "Smoke Damage Diagnosis" were as follows:

Dr. Garber (Hamburg): Experience in the analysis of leaves in research on smoke damage.

Prof. Dr. Kisser (Vienna): Symptoms of damage by acids and tar.

Prof. Hartel (Graz): New experience with the turbidity test.

Dr. Merz (Munich): Testing damage by fluorine.

Dr. Stratmann (Essen): Analysis of air for estimating the danger to vegetation.

Reports on the consequences of air pollution were as follows:

Dipl. Forsting Pelz (Tharandt): Research in fructification of pine trees damaged by smoke.

B. Maran, Academician (Prague): Damage to agriculture and forestry by smoke emissions in Czechoslovakia.

Prof. Dr. Rohmeder (Munich): Effects of soot and dust on the growth of pine trees.

RR. Dr. Wentzel (Bochum): Research on annular rings of trees in the neighbourhood of former emissions.

" Corrective Measures for Forests " were debated in the reports of:

Dipl. Forsting Lampadius (Dresden): Prevention against smoke damage.

Prof. Dr. Kisser (Vienna): Forest experience and expedients in the area of damage around an aluminium plant.

Prof. Dr. Rohmeder (Munich): Cultivation of pine varieties resistant to industrial waste gases.

On the second day the members of the conference took part in a round trip to see the different appearance of woods, demonstrated by Dr. Wentzel, in the industrial region near Bochum, which of course led to an interesting interchange of views.

On the third and last day Dr. Stratmann (Essen) demonstrated his testing plant at Biersdorf (Westerwald), which the VDI Commission on air pollution is looking after. According to statement by Dr. Stratmann and his co-workers Dr. Guderian and Dr. van Hout, the only source of pollution in this valley—a smelting plant—makes it possible to study the effect of SO_2 and its influence on the vegetation at different distances from the source; that is, for different concentrations of SO_2 in the air.

Professor Dr. Kisser (Vienna) was the chairman for the significant final discussion.

Although some of the reports will be published in special periodicals in the original text, Dr. Wentzel has made a general abstract of the proceedings, with all the reports and discussions. A copy may be obtained by any interested person from the " Landesanstalt für Bodennutzungsschutz," Bochum, Western Germany. It is however written in German.

CALIFORNIA'S NEW " AUTO SMOG " LAW

With the passage of Assembly Bill No. 17 on April 5th, 1960, California became the first American state to take legislative action against pollution of the air by the automobile. The new law promises the virtual end of smog in the Los Angeles Basin within five years *if:* (1) devices are developed and installed as scheduled, and (2) strict control is maintained over pollution from industry and the disposal of rubbish.

The law requires the installation on motor vehicles of officially approved devices for the prevention of pollution. This part will come into effect from the day a state board certifies that at least two devices are approved, after which within one year one must be fitted to all new vehicles throughout the state, and on used vehicles in counties affected by the law if there is a transfer of ownership; within two years on all used commercial vehicles in counties affected; and within three years on all motor vehicles located in a county affected. Counties not affected have in effect to opt out after a public hearing to establish that there is no pollution problem in that county.

From the descriptive material issued with the text of the law (by the Los

Angeles County Air Pollution Control District) it is not apparent whether the devices required to be approved are, or soon will be, on the market.

Other important sections of the law deal with other pollution sources as follows by:

Prohibiting outdoor fires.

Prohibiting the use of single-chamber incinerators.

Prohibiting from May 1st to October 31st, the burning of fuel oil or gas containing more than 0·5 per cent sulphur.

Prohibiting after June 30th, 1960, the sale for motor fuel of gasoline having a Bromine number of more than 30.

Dr. Leonard Greenburg, commissioner of New York City's Department of Air Pollution Control has resigned to become a professor of preventive medicine at the Albert Einstein College of Medicine of Yeshiva University in the Bronx.

CINCINNATI CONVENTION

The 53rd Annual Convention of the Air Pollution Control Association of America was held at Cincinnati on May 22nd to 26th, 1960. Sixty-six papers are listed for presentation in the programme, covering such headings as community surveys, industrial air pollution control, air quality standards, automotive exhaust research, health effects research, air quality monitoring and sampling methods, zoning planning and administration, meteorological research, control equipment research, instrument development, agricultural research and " general " and " keynote " sessions. A sectional conference for Control Officials debated the question of State *v.* Local Enforcement.

We hope to publish abstracts of the papers in our next issue.

INTERNATIONAL BIOCLIMATOLOGICAL CONGRESS

The second Congress of the International Society of Bioclimatology and Biometeorology will be held in London from Sunday to Saturday, September 4th to 10th, 1960. Among the specialized working groups, meeting during the afternoons of the congress will be one on Atmospheric Pollution, under the chairmanship of Dr. K. Bisa, of Germany. Full particulars of the programme and arrangements may be obtained from the Secretary-General of the Society, Dr. Solco W. Tromp, Hofbrouckerlaan 54, Oegstgeest (Leiden), Netherlands.

Precipitator Contract

The Steel Company of Wales have awarded Simon-Carves Ltd. the contract for gas-cleaning plant on two 400-ton open-hearth furnaces which are being installed at Port Talbot. A contract for fume removal and gas cleaning plant for a hot slab scarfing machine has been awarded to the same company by the South Durham Steel & Iron Co. Ltd. This machine will form part of the new plate mill being installed at South Works, West Hartlepool.

Metro-Flex Control

The Metropolitan Engineering Company Ltd. (47 Whitechapel High Street, London, E.1.), manufactures equipment to promote efficiency and control in steam-raising plant and issues technical data sheets that should interest many of our readers. A thermal storage system, gas tight sealing technique and draught control are among the subjects dealt with.

Committee's Report on Solid Smokeless Fuels

The End of Coke?

Report of the Committee on Solid Smokeless Fuels. Cmnd. 999. H.M. Stationery Office. pp. 28. 1s. 3d. net.

THE small committee of four, under the chairmanship of Mr. N. M. Peech, appointed by the Minister of Power to inquire into the solid smokeless fuel situation, was required to report on availability, suitability, future production and distribution, in view of requirements for implementing the Clean Air Act. Many of the conclusions reached, especially on suitability, confirm what has been previously known and said, but it is valuable to have them set down, and backed by firm evidence, as the considered findings of an official committee.

The criticisms or doubts that are frequently expressed about solid smokeless fuels and their general suitability, or acceptability, for replacing raw coal, should be effectively dispelled by the quite thorough investigation—which included practical demonstrations—made by the Committee. The conclusion is reached that " the specially reactive manufactured fuels can give satisfactory service on both unimproved and improved open grates and that coke to the British Standard Specification and low volatile steam coals other than dry steam coal, can give satisfactory service on improved open grates."

The main line of criticism has been that there are not enough of what the report calls the " specially reactive " fuels (which is a term to be preferred to " premium " fuels), and that coke is not so acceptable, having, as the report puts it " associations for many people of variation in quality and indifferent performance." The report welcomes the British Standard Specification for open fire coke and states that " it is highly desirable that this coke should be sold under a brand name to distinguish it from the general run of coke." This is a development that this journal suggested a long time ago, and we are glad that it is at last coming. B.S. coke is already being sold in some areas under the name " Gloco " and we trust that this will soon become nationally known and recognized, and that the name coke will before long disappear from the list of domestic fuels.

The conclusion is reached that " after investigating the main criticism made about solid smokeless fuels, particularly coke, and after considering practical, oral and written evidence of their qualities, that the specially reactive manufactured fuels can give satisfactory service on both unimproved and improved open grates and that coke to the British Standard Specification and low volatile steam coals, other than dry steam coal, can give satisfactory service on improved open grates."

Availability

The report closely examines the availability and future supply position of the different smokeless fuels, and concludes that for the immediate future there should be an adequate supply of the specially reactive fuels. The sales of these in 1958 were 735,000 tons, but this year (1960) availability should exceed one million tons.

The Ministry of Power have made an estimate of the maximum demand for solid smokeless fuels in 1965. This has been done on the basis of the best available assessment of the spread of smoke control and allowance has been made for an increase in demand in areas expected not to be subject to control by 1965. It is estimated that by then the annual demand will have risen from the current level of about 6 million tons (in a year of normal temperature) to about 11½ million tons. How the demand for the extra 5½ million tons will be divided is not easy to assess, but the Ministry tentatively breaks it down thus:

	Million tons
For unimproved open grates	1
For improved open grates ..	4
For closed appliances ..	½

Pointing out that there are ample supplies of fuel for closed and openable stoves, the report recommends " an increased emphasis on the virtue of closed and openable stoves in Government and local authority publicity and education in connection with clean air." In particular it urges that their installation should be encouraged in the Northern Region. By reducing the demand for open fire fuels the greater use of closeable stoves will lessen the possibility of the smoke control area programme being held up at some future date by lack of such fuels. The recommendation can also be supported on the further ground that the use of closed stoves, which considerably reduce fuel consumption, is perhaps the most important available means for reducing the emission of the sulphur oxides which are present in the combustion products of all the solid fuels.

On the additional supplies of coke that will be needed the report sums up thus:

" We are assured that the gas industry could make available the additional supply of about ¾ million tons per annum of British Standard coke necessary to bring the total availability of fuels suitable only for the improved open grate to 4 million tons per annum by 1965. Because of the better availability in relation to estimated demand of fuels suitable for the improved open grate we regard it as most important that full use should be made of the provisions of the Clean Air Act under which grants are available for the installation of these grates in smoke control areas. It might be fatal to the progress of clean air if people living in smoke control areas did not have reasonable freedom of choice in their selection of fuel and this freedom of choice could not exist if the grates installed in their homes were unable to burn coke and low volatile steam coals of suitable quality.

" The British Standard Specification for open-fire coke is a great step forward and it is important that everything possible should be done to make this coke acceptable to the consumer. We regard it as essential that as soon as practicable all coke used in improved open grates should be made to the Specification, that this coke should not be supplied for use on unimproved grates and that consumers should know how to get the best lighting and burning results with it. These three objectives can be achieved, we consider, by a combined operation of producers and distributors."

Present and Future Availability

The report gives as an appendix a table of the sales of the different smokeless fuels in 1958 and 1959, and availability forecasts for 1961, 1963 and 1965. The figures for 1959 and 1965 may be quoted to show the prospective increases over the half decade now beginning.

Suitable for Unimproved and Improved Open Grates	*(thousand tons)* 1959	1965
" Coalite " (large) ..	520	600
" Rexco " (large) ..	50	120
Cleanglow	213	435
Phimax	63	58
Warmco	64	267
Total ..	910	1,480
Suitable for Improved Open Grates		
Gas Coke	1,000	2,637
Hard Coke	50	50
Low volatile steam coal	—	615
Total ..	1,050	3,302

Suitable for Closed Stoves		
" Phurnacite " ..	584	800
Anthracite	679	1,300
Dry Steam Coal ..	781	1,200
" Coalite " (cooker)..	37	60
" Rexco " (nuts) ..	35	80
Gas Coke	1,214	2,288
Hard Coke	282	1,538
Total ..	3,612	7,266
Grand Total ..	5,572	12,048

This is a most encouraging forecast, especially as it is based on the firm plans of producers and does not include possibilities that are not yet certain. Especially interesting are the increases in anthracite, dry steam coal, coke and hard coke for closed stoves and of low volatile steam coal for improved open fires. It is pointed out that the third category—suitable for closed stoves—the quantities shown are those that could be made available to the domestic market not all of which are likely to be required. This stresses the importance of encouraging the closed stove.

Other Recommendations

The report discusses many other points of importance and makes a number of useful recommendations. It deals with the smokeless fuel problems in Scotland, where at present no specially reactive fuels are produced (except for a few hundred tons of a special coke, " Grancole " in Edinburgh). It suggests that when the intentions of local authorities regarding smoke control areas in Scotland are known, the Scottish Gas Board and the National Coal Board should examine the need for taking special steps to meet any deficiency in supplies. Proposals by other producers to manufacture these fuels in Scotland, such as that of " Rexco," should be encouraged.

On the question of ignition of the fuels the report considers that where-ever possible open fires should be fitted with integral gas ignition. Where town gas is not available it may be possible to use bottled gas, and there is also the possibility of a smokeless firelighter being produced. A new electric igniter, working something like a hair-dryer, is not mentioned, probably because information about it was not available when the committee examined this question.

Marketing and distribution problems are considered, and although there was no real evidence to show that the margins available to merchants were inadequate, " there does seem to be some substance in the suggestion that as coke becomes a larger part and coal a smaller part of a merchant's business, an upward adjustment of the margin on coke will be necessary having regard to the extra storage space required and additional handling." The summer/winter price scheme should be kept continually under review, and deliveries should be made regularly and in quantities convenient to householders. It will also be well worthwhile to explore the possibilities of packaged fuel.

The need for educating the public in the use and appreciation of solid smokeless fuels is, we are glad to note, well emphasized:

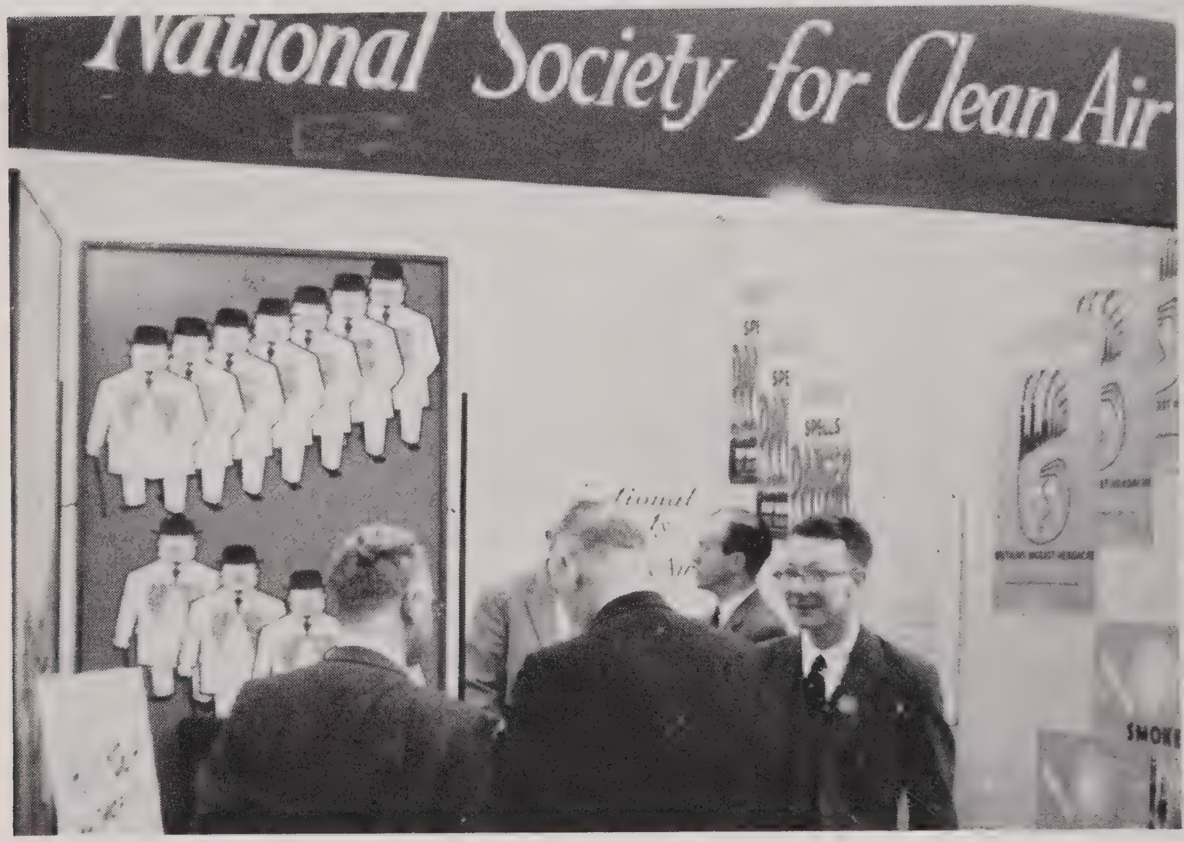
> " Good marketing can play a most important part in solving problems that have arisen in the use of solid smokeless fuels. If they are to give satisfactory results these fuels require rather different treatment from normal house coal and information should be readily available to the consumer on how, for instance, to lay the fuel and ignition bed and when and how much refuelling will be required. This information should be simply set out in leaflets prepared by the producers of the fuels and merchants should issue them with each delivery of fuel."

We would strongly endorse the proposal made in the last sentence above, and hope that it will be acted upon by the producers and the merchants.

Finally, we also hope that note and action will be taken of the following paragraph:

> " A statistical basis for estimating the use of solid smokeless fuels in the three categories of appliance, for the

country as a whole and on a regional basis, would be a great help in future assessments. Surveys of domestic fuel use in selected smoke control areas and other selected areas should be undertaken urgently. In view of the changing circumstances, particularly the clean air progress that may be achieved, the number of improved grates that may be installed, and expansion in the use of electricity, gas and oil, it is essential to review and re-assess the findings in this Report in two years' time."


National Society for Clean Air

Clean Air at Torquay

Two views of the Society's stand at the Royal Society of Health's Exhibition during their Congress at Torquay in May. The stand was designed in particular to draw attention to the publicity and other services the Society has to offer, especially to local authorities. It attracted many inquirers and other visitors.

In the photograph above, helping "customers" is to be seen (at the back) Mr. John Innes, our chairman, who was a delegate at the Congress, and our Administrative Secretary, Mr. L. Nevard.

QUESTIONS IN PARLIAMENT

No Smokeless Fuel Shortage

Mr. Ellis Smith asked the Minister of Housing and Local Government and Minister for Welsh Affairs if he will make a statement on the implementation of the Clean Air Act up to the present moment; what is his estimate of the further action required to make the Act fully effective; to what extent local authorities are collaborating to enforce the provisions of the Act; and how far such proposals are hampered by shortage of supplies of smokeless fuels.

Sir K. Joseph: The main need is for more smoke control areas in the worst polluted parts of England and Wales. My right hon. Friend has not found it necessary to defer, because of shortage of smokeless fuels, any proposals made to him. (*March 29th*, 1960).

" Very Undesirable "

Mr. Ellis Smith asked the Minister of Housing and Local Government and Minister for Welsh Affairs on what dates he received the documents relating to clean air sent to him by the Coal Merchants Federation and the Manchester and Stoke areas; and what advice he gave in his replies to ensure the application of his clean air policy.

Sir K. Joseph: My right hon. Friend first heard of these early in February, and on March 16th he told the Coal Merchants Federation in discussion that they seemed to him very undesirable. He heard about them from Manchester on March 17th, and has told them that he has made representations to the Federation; he has not heard from Stoke. (*March* 29th, 1960).

Diesel-engined Vehicles

Mr. D. Smith asked the Secretary of State for the Home Department how many prosecutions were initiated by the Metropolitan Police in 1959 for the offence of emitting smoke from diesel-engined vehicles to the danger of other road users.

The Joint Under-Secretary of State for the Home Department (Mr. David Renton): There were seventy-two prosecutions in the Metropolitan Police District in 1959 under the Regulation which makes it an offence in certain circumstances to use a motor vehicle which emits smoke. No record is kept of the types of vehicles concerned.

Mr. Smith: Will my hon. and learned Friend bear in mind the fact that these offences are by no means on the decrease? They cause considerable annoyance to road users, especially in the Greater London area. Will he ask his right hon. Friend to use his influence to persuade the police to take a little more active interest in this matter?

Mr. Renton: In the Metropolitan area, to which the Question refers, this is a matter for the Commissioner and he is anxious to enforce the law in this respect. (*March 17th*, 1960).

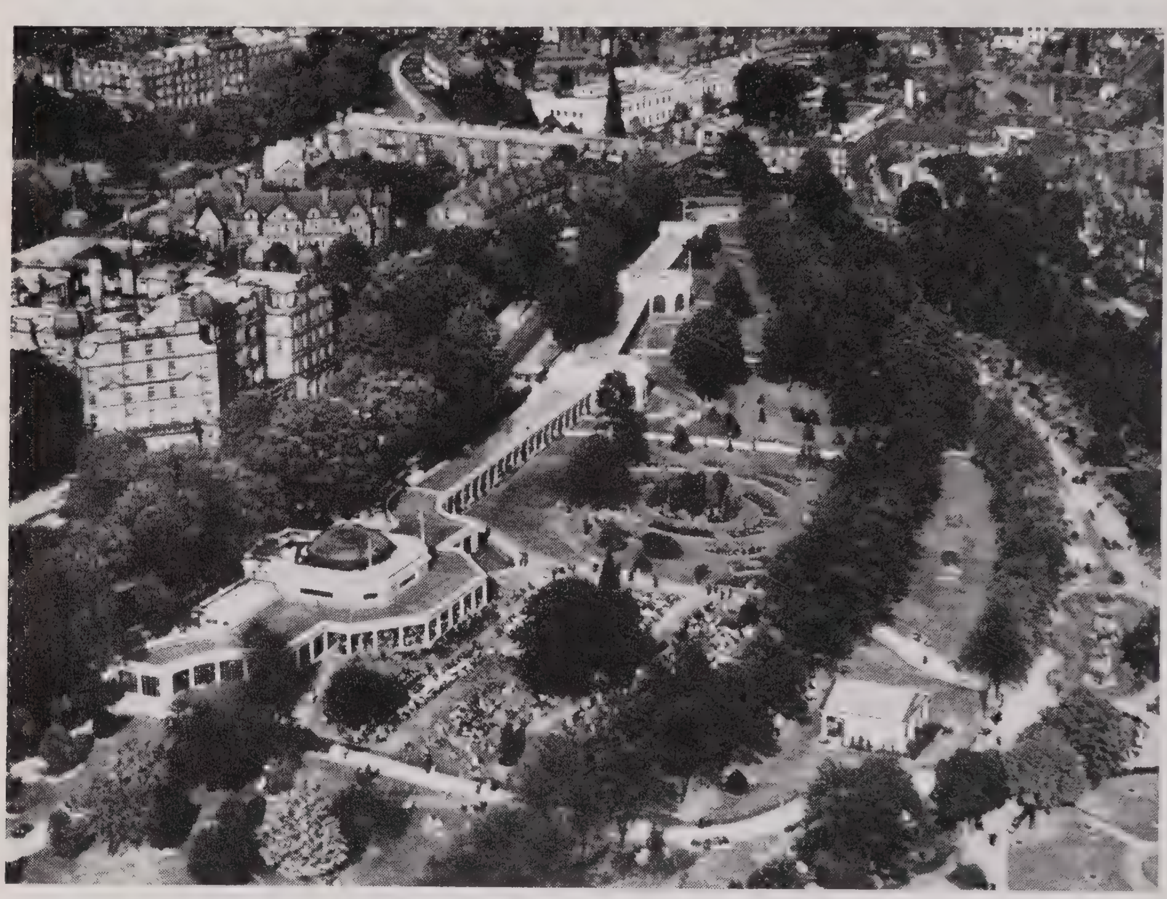
Mr. Dudley Smith asked the Minister of Transport whether he will give official publicity to the penalties which attach, under the Construction and Use Regulations, to lorry owners who permit the emission of smoke by their vehicles, and to the possibility of avoiding such penalties by correct vehicle maintenance.

Mr. Marples: I am sure that vehicle owners and drivers are in general aware of the regulations and the penalties for breaking them. My technical officers take every opportunity to impress on them that adequate maintenance, correct adjustment of engines and care in driving can prevent the emission of exhaust smoke. I will certainly consider what further action I can take to give increased publicity to this matter. (*March 30th*, 1960).

Time for Clean Air

Sale Borough Council are to spend £200 on four new faces for the town hall clock. The present faces have been damaged by atmospheric pollution.

Coming to Harrogate?



The famous Valley Gardens at Harrogate

We are hoping that the attendance at the Society's Conference at Harrogate on October 5th to 7th will not fall very short of the record set up last October for the International Conference. The most important discussions will be on reports on the questionnaire sent out by the Society to all local authorities on the working of the Clean Air Act. There has been an excellent response, and although at the time of writing the analysis of the information was only just being begun, it was apparent that a great deal of useful information, or interest to everyone concerned with clean air, will be forthcoming, There will be two reports, one on the industrial and the other on the domestic aspects, and they will be presented by Dr. W. C. Turner (M.O.H. Poplar) and Mr. E. M. Birtwisle (C.P.H.I. Horsforth).

We are pleased to be able to announce that the Conference and Exhibition will be opened by the Parliamentary Secretary of the Ministry of Housing and Local Government, Sir Keith Joseph, M.P. Sir Keith has already shown his keen interest in our problem and a first-class address from him is assured. As previously reported, the Presidential address will be given by Sir Hugh Beaver, and the Des Voeux Memorial Lecture by Sir Linton Andrews, of the *Yorkshire Post*. Then there is the session on pollution from road vehicles—emphasizing in particular the prevention of visible smoke—to be opened with a paper by Douglas Lister, and the " open session " of invited papers on develop-

Sir Keith Joseph, M.P.

Sir Linton Andrews

ments and progress. The list of these papers, with authors and subjects, is not yet complete, but enough contributions have been offered to make this feature both interesting and useful.

The Exhibition will be easily the biggest and best clean air exhibition ever held. We have been gratified by the support that has been given to it by industry and research organizations. Even if you are unable to come to Harrogate for the whole of the conference a journey just to see the exhibition will be rewarding.

HARD COKE

A reception was held recently at the Acton Testing Station of the British Coking Industry Association, when guests from other organizations, firms and the Press had the opportunity of seeing the equipment and the work being done at the Station. It was established about four years ago and since that time a considerable volume of work has been done on the use of hard coke in domestic appliances and on hard coke itself. The coking industry produces some 15 million tons of coke for metallurgical purposes each year but in addition 4 to 5 million tons are produced in special sizes for other markets, including the domestic. At Acton the work is particularly on domestic applications, and the station is now taking a share in the work of testing for approval new appliances brought forward to the Domestic Solid Fuel Appliances Approval Council for examination.

In a speech welcoming the guests Sir Frederick Scopes said “ We are proud that this laboratory is working hand in hand with laboratories of the Gas Council, the National Coal Board, B.C.U.R.A., and of certain appliance manufacturers, to ensure that only first-class appliances are placed on the approved list and offered to the public. We are certain that the regular examination of performance standards necessitated by the work of these many laboratories will ultimately raise the whole standard of heating in British homes.”

THE BLACK AREAS

Is a Revision Needed?

In an address to the Annual Conference of the Society's Scottish Division at Aberdeen on May 19th, on progress under the Clean Air Act, Arnold Marsh, Director of the Society, discussed the " black area " classification for smoke control. Pointing out that he was expressing only personal thoughts, Mr. Marsh said:

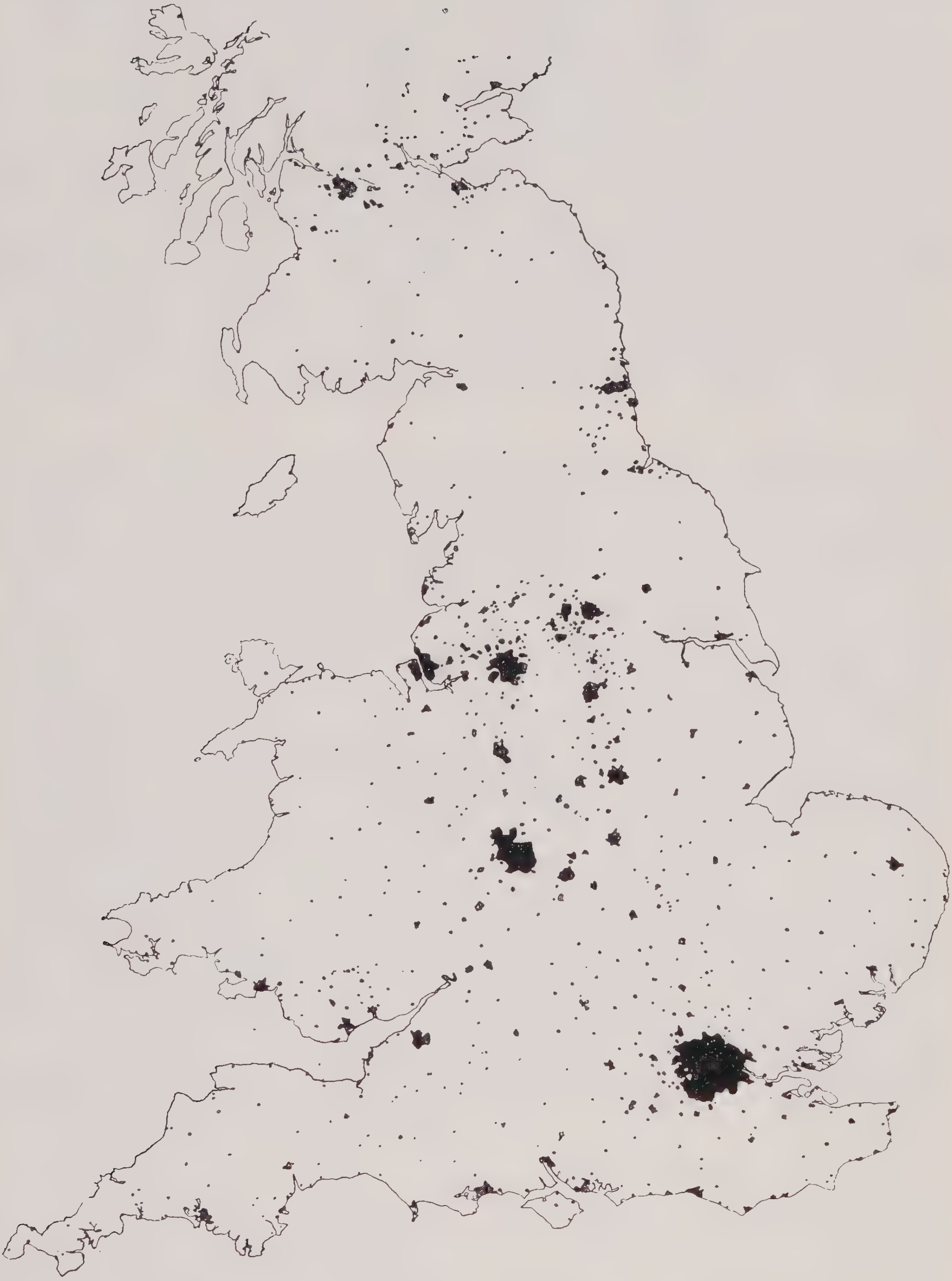
The idea of the " Black Areas " was put forward by the Beaver Committee in its reports, indicating which towns and districts should have priority in the creation of smoke control areas. A map published with the Committee's Interim Report indicated the main industrial areas and those where fog was most liable to turn to smog. " Within these areas are the black spots in which the gravest conditions recur and where the evils of air pollution are most pronounced and most persistent. It is here that the need for amelioration is most urgent."

This classification has been valuable for the first planning of smoke control area development, and also for enabling both the authorities and the public to know where they stood. Possibly, however, the time has come to consider whether the division of the country into the black areas and the rest cannot be improved, whether more attention should be given to chronic pollution rather than to smog alone, and whether in fact the conception of black areas is adequate for the future.

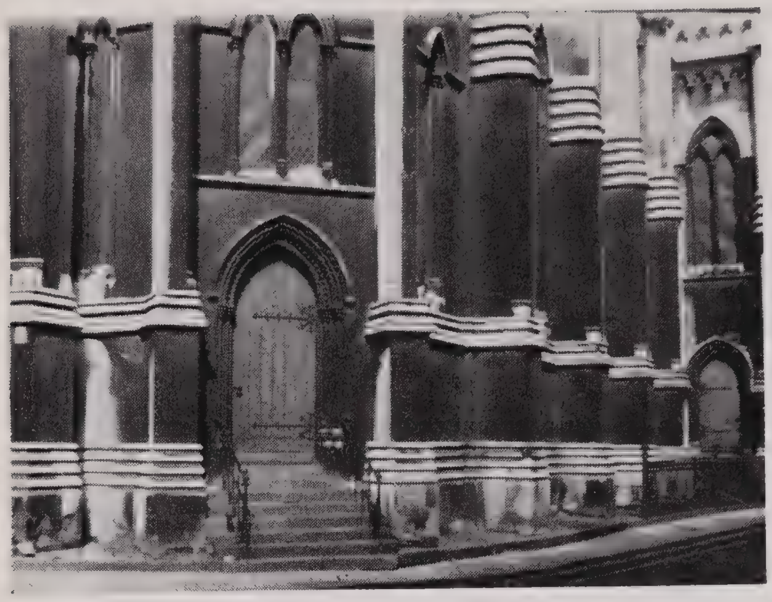
In the first place to call certain areas " black " leads to the remainder being regarded as " white," and therefore having little need for smoke control. As an example may be cited recent opposition to proposals for smoke control areas—from the usual quarters of course—in the city of Exeter. One argument was that the city was in a white area and therefore it should be left alone until all the black areas had been made smokeless. Cities and large towns such as this may be far from the designated black areas, but by no means can they be regarded as free from serious air pollution, having their own industries and thousands of houses, for the most part clustered close together. Many of these towns, like Exeter, have famous cathedrals and other buildings of great historic importance, which are being damaged by air pollution and for which repairs at heavy cost are needed.

But one of the principal reasons for looking afresh at the question is the new evidence on the behaviour of smoke in the atmosphere, as discussed in the Fuel Research Report for 1958, recently published. The larger number of smoke filters now in use and the analysis of their records has made it possible to obtain a clearer and rather surprising picture of what happens. The conclusion is reached that the concentration of smoke in the atmosphere of a town varies relatively little with the size of the town. There are a few rural and coastal areas that can be called really clean, with a smoke concentration of 2 to 3 milligrams per 100 cubic metres. There are also a few really black spots where the concentration is over 30, and still fewer where it is over 40 mg./cu.m. In the vast majority of towns, whether they are in black or white areas, with a population range of 5,000 to a million, the smoke concentration lies between 10 and 30 mg./100 cu.m.

This finding is in accordance with the knowledge we now have that smoke is dispersed, generally, more by moving in an upward direction, through the turbulence of the atmosphere, than by being blown sideways by the wind. There is of course plenty of evidence about the drift of pollution which must not be overlooked, but it now seems clear that much of it does,



Map showing the towns and areas where the smoke concentration is above 10 mg/100 cu. metres. Reproduced from the Fuel Research Report for 1958, reviewed in our last issue and discussed in the adjoining Paper



Smoke Grime at Bath

One of the towns outside the "black areas," as discussed below, which clearly needs full smoke control, is the city of Bath. Its gracious buildings show many signs of the effects of its own—mainly domestic—smoke emissions. The photo shows the "soot and whitewash" appearance of the Church of St. Michael and St. Paul.

so to speak, hang about its place of origin. This helps to explain why the improvement in conditions in a smokeless zone or smoke control area is being found to be much greater than some early forecasts (based on the inadequate Hyde Park observations) had suggested.

From this it might be proposed that every town of 5,000 or more population should be regarded as a black area in itself and therefore requiring smoke control. Because of the possible difficulties relating to smokeless fuel in the future this might be going too far for the time being, and despite the new evidence it is probable that a town of 20,000 will benefit much more from smoke control than one of 5,000. Except for the factor of smog formation on occasion it might even be argued that some of the larger towns in the white areas should have priority over some of the smaller ones in the black areas.

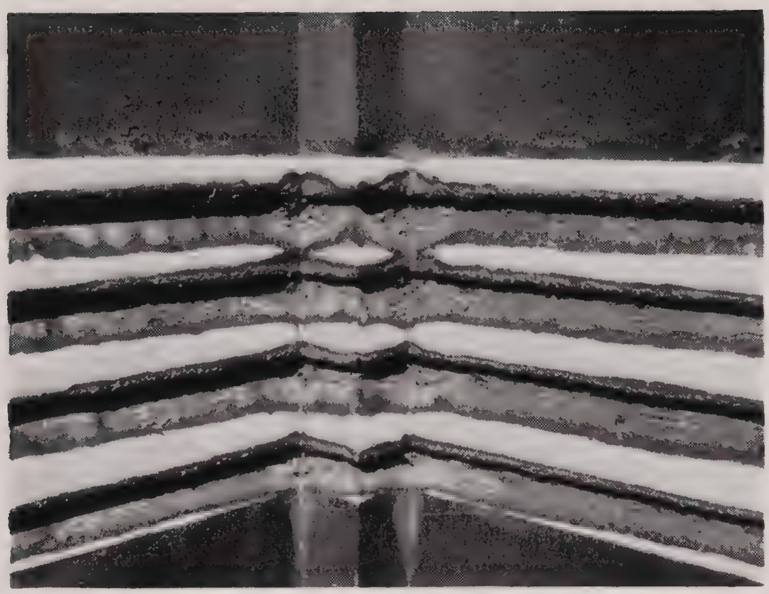
Put forward simply to promote discussion, and bearing in mind that there may be other approaches, a new classification of areas might be on the lines of:

1. The conurbations, or continuous built-up areas.
2. Towns outside the conurbations down to 20,000 population.
3. Towns down to 5,000 population.
4. Rural areas.

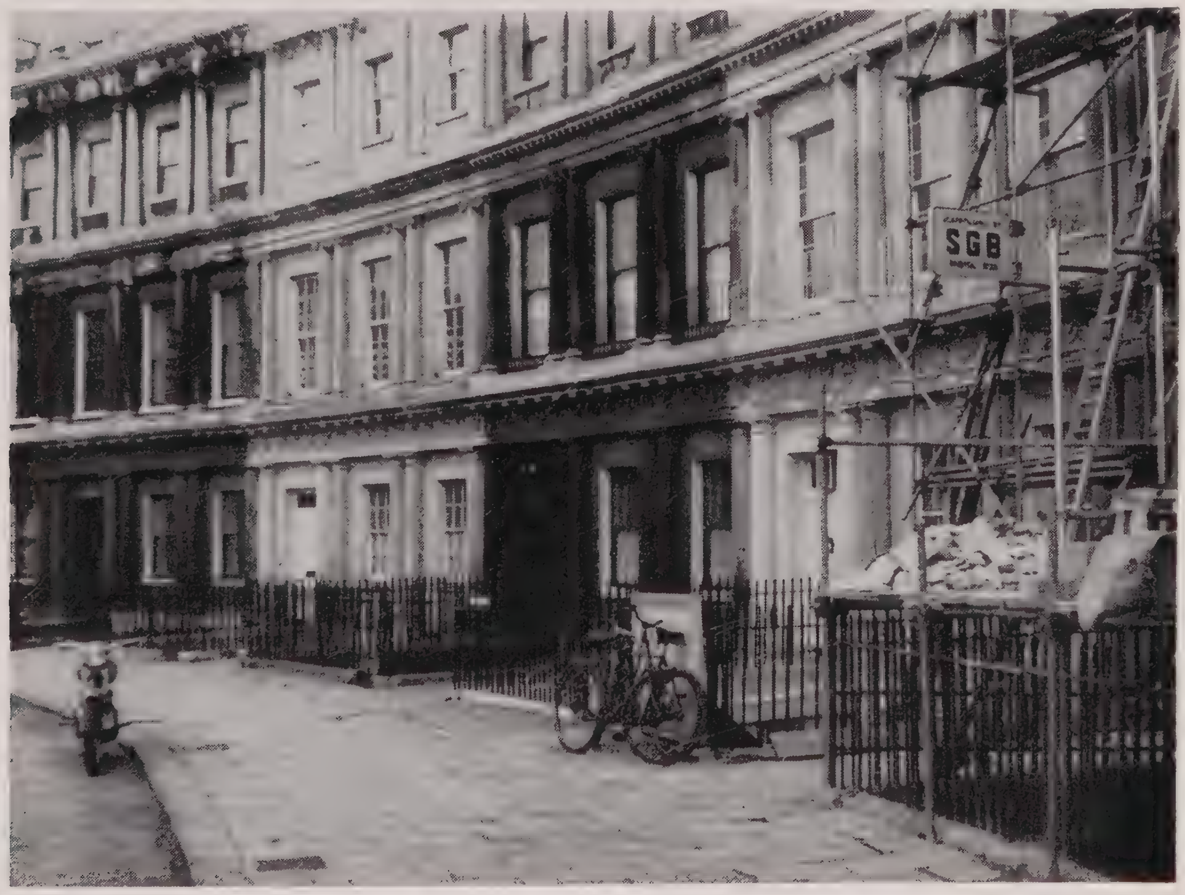
For the present it could be suggested that the first category should have top priority in the establishment of smoke control areas, but that No. 2 should follow very closely. No. 3 should have low priority, except in special circumstances (such as the development of a new town, which could be smokeless from the start), and No. 4 should for a long time to come be ignored.

The map and references in the Beaver Reports were not precise about the black areas, but a provisional list was issued last year by the Ministry of Housing and Local Government (see *Smokeless Air*, Summer 1959, No. 110, page 262). It does not include the city which has already been mentioned, Exeter, which may be given as an example of the kind of place one has in mind for No. 2 category. Other examples are Bath, Canterbury, Cambridge, Norwich, Lincoln, Ipswich and Carlisle. Some recent photographs of Bath show the blackening and erosion of its buildings, which demonstrate why such a lovely city needs smoke prevention for aesthetic as well as other reasons.

I am not sure about the Scottish black areas, or whether any list has been published of the towns included in them, but outside the obvious Clyde and Forth regions it may be suggested that No. 2 category towns would include at least Aberdeen, Perth, Dundee, Kirkcaldy, Ayr and Inverness.



A close-up of the wall of the Bath church illustrated opposite, showing deposits on the under side of the ribbing, the cleanliness of the surfaces acted on by rain, and general erosion. If touched, portions of the stone crumble in the fingers. Below are houses in the Circus, Bath, showing the results of stone cleaning now in progress, or the " brides at a funeral " effect.



Publications Received

Among many publications received by the Society mention must be made of the *Annual Report of the British Iron and Steel Research Association* (11 Park Lane, London, W.1.), which will be of much interest to readers who are concerned with progress in this industry. To mark its 21st anniversary the British Coal Utilization Research Association (Randalls Lane, Leatherhead, Surrey), has published a *Bibliography of Publications*, which lists under subject and author the numerous publications of the Association. It is an imposing list which gives some impression of the important work done by BCURA. This mention gives us the opportunity of offering our cordial birthday greetings.

SMOKE CONTROL AREAS

Progress Report

POSITION TO APRIL 30th, 1960—TOTALS

	England and Wales	Scotland
Smokeless Zones (Local Acts) in Operation	44	1
Acres, 3,400		
Premises, 41,060		
Smoke Control Areas in Operation	122	3
Acres, 14,120		
Premises, 99,446		
Smoke Control Orders—		
Confirmed	138	6
Submitted	103	3
Proposals Notified	285	11
Not Confirmed (*Deduct*)	1	
Grand Totals	691	24

The lists given below are supplementary to the information in the last issue of *Smokeless Air* (Spring, 1960), which gave the position up to December 31st, 1959. They now show the changes and additions to April 30th, 1960.

Some of the areas listed are new housing estates, or areas to be developed for housing. The total number of premises involved will therefore increase. An asterisk denotes that there have been objections and that an informal inquiry has been or will be held.

ENGLAND AND WALES

New Smoke Control Areas in Operation

Brierley Hill Nos. 1 to 7, Droylesden U.D. No. 1, Knottingley U.D. No. 1, Middleton B. No. 1, Newport C.B. No. 1, S.E. Derbyshire R.D. No. 2, Stalybridge B. No. 2, Willenhall U.D. No. 6.

New Orders Confirmed but not yet in Operation

Acton B. Nos. 1 to 3, Aldridge U.D. No. 1, Bolton C.B. Nos. 4 and 5, Brownhills U.D. No. 1, *Chadderton U.D. No. 1, Chelsea M.B. No. 1, Chingford B. No. 1, Dewbury C.B. No. 1, Doncaster C.B. Nos. 2 to 5, Ealing B. No. 2, East Barnet U.D. No. 1, Edmonton B. No. 2, Friern Barnet U.D. No. 1, Failsworth U.D. No. 1, Fulham M.B. No. 3, Gateshead B. Nos. 1 and 2, Hackney M.B. No. 2, Hornchurch U.D. No. 2, Hornsey B. No. 2, Ilford B. No. 1, Islington B. Nos. 1 and 2, Kingswood U.D. Nos. 1 and 2, Lewisham M.B. No. 4, *Luton B. No. 1, *Old Fletton U.D. Nos. 1 and 2, Paddington M.B. No. 2, Pontefract B. No. 1, Prestwich B. No. 3, Richmond (Surrey) B. No. 1, Rochdale C.B. No. 2, Rotherham C.B. Nos. 8 to 10, Salford C.B. Nos. 2 and 4, Sheffield B. No. 3, Solihull B. No. 1, Stepney M.B. No. 1, Stoke Newington M.B. No. 4, Wakefield C.B. No. 1, Wallasey C.B. No. 3, Wandsworth M.B. No. 2, Warrington C.B. No. 1, *Wath-upon-Dearne U.D. No. 1, Westminster M.B. No. 3, Wilmslow U.D. No. 4, Wood Green B. No. 2, Woolwich M.B. Nos. 5 and 6, Wortley R.D. No. 3.

New Orders Submitted for Confirmation but not yet Confirmed

Bolton C.B. Nos. 6 to 10, Brierley Hill U.D. Nos. 8 to 10, Burnley C.B. No. 1, Chadderton U.D. No. 2, Chesterfield B. No. 1, Church U.D. No. 1, Coventry

C.B. Nos. 1 and 2, Croydon C.B. No. 2, Droylsden U.D. Nos. 3 to 7, Ealing B. No. 3, Ellesmere Port B. Nos. 2 and 3, Grantham B. Nos. 1 and 2, Hammersmith M.B. No. 2, Hayes and Harlington U.D. No. 13, Heckmondwike U.D. No. 1, Holborn M.B. No. 3, Hornchurch U.D. No. 2, Huyton-with-Roby U.D. No. 1, Leamington Spa B. No. 5, Mirfield U.D. No. 1, Newcastle-upon-Tyne C.B. No. 2, Poplar M.B. Nos. 1 to 6, Runcorn U.D. No. 1, St. Pancras M.B. No. 2, Southall B. No. 2, Staines U.D. No. 1, Stretford B. No. 1, Wallasey C.B. No. 4, Wanstead and Woodford B. No. 1, Wilmslow U.D. Nos. 1 and 5, Wortley R.D. No. 2, Yiewsley and West Drayton U.D. No. 1.

Proposals Notified to the Minister

Acton B. Nos. 1 to 3, Aldridge U.D. No. 1, Ashton-under-Lyne B. Nos. 2 and 3, Barnes B. No. 1, Barking B. No. 1, Batley B. No. 1, Battersea M.B. No. 2, Bebington B. No. 2, Beddington and Wallington B. No. 2, Bedford B. No. 3, Beeston and Stapleford U.D. No. 1, Birmingham C.B. Nos. 5, 7 and 9, Blackburn C.B. No. 1, Bolton C.B. Nos. 4 and 5, Bootle C.B. No. 3, Brentwood U.D. No. 2, Brierley Hill U.D. Nos. 8 to 10, Bristol C.B. Nos. 2 to 7, Bromley B. Nos. 1 and 2, Brownhills U.D. No. 1, Burnley C.B. No. 1, Chadderton U.D. No. 2, Chelsea M.B. No. 1, Cheltenham B. No. 1, Cheshunt U.D. No. 1, Chesterfield B. No. 1, Chingford B. No. 1, Church U.D. No. 1, Corby U.D. No. 1, Coventry C.B. Nos. 1 and 2, Crewe B. No. 1, Crompton U.D. No. 2, Croydon C.B. No. 2, Darlington C.B. No. 1, Deptford M.B. No. 2, Derby C.B. No. 2, Dewsbury C.B. No. 1, Doncaster C.B. Nos. 2 to 5, Droylsden U.D. Nos. 2 to 7, Dudley C.B. No. 4, Ealing B. Nos. 2 to 4, East Barnet U.D. Nos. 1 and 2, Edmonton B. No. 2, Ellesmere Port B. Nos. 2 and 3, Eston U.D. No. 1, Failsworth U.D. No. 1, Friern Barnet U.D. No. 1, Fulham M.B. Nos. 3 and 4, Gateshead B. Nos. 1 and 2, Grantham B. Nos. 1 to 3, Hackney M.B. No. 2, Halesowen B. Nos. 2 and 3, Hammersmith M.B. Nos. 2 and 3, Hayes and Harlington U.D. Nos. 13, 15 and 18, Hebburn U.D. No. 1, Heckmondwike U.D. No. 1, Hendon B. No. 2, Holborn M.B. Nos. 2 and 3, Hornchurch U.D. No. 2, Hornsey B. Nos. 2 and 3, Huyton-with-Roby U.D. No. 1, Ilford B. No. 1, Irlam U.D. No. 2, Islington B. Nos. 1 and 2, Jarrow B. No. 1, Kensington M.B. No. 3, Kingston-upon-Hull Nos. 4 to 8, Kingswood U.D. Nos. 1 and 2, Leamington Spa B. No. 5, Leeds C.B. Nos. 3 and 4, Lewisham M.B. No. 4, Leyton B. No. 2, Liverpool C.B. No. 11, Luton B. No. 1, Marple U.D. No. 1, Mirfield U.D. No. 1, Newcastle-upon-Tyne C.B. Nos. 2 to 4, Northfleet U.D. No. 1, Old Fletton U.D. Nos. 1 and 2, Paddington M.B. No. 2, Pontefract B. No. 1, Poplar M.B. Nos. 1 to 6, Prescot U.D. No. 1, Prestwich B. No. 3, Radcliffe B. No. 1, Reading C.B. Nos. 6 and 7, Richmond (Surrey) B. Nos. 1 and 2, Rochdale C.B. No. 2, Rotherham C.B. Nos. 8 to 10, Runcorn U.D. No. 1, St. Marylebone M.B. No. 4, St. Pancras M.B. No. 2, Sale B. No. 1, Salford C.B. Nos. 2 and 4, Sheffield C.B. Nos. 3 and 5, Shipley U.D. No. 2, Shoreditch M.B. No. 2, Slough B. No. 1, Smethwick C.B. No. 3, Solihull B. No. 1, Southall C.B. No. 2, Staines U.D. No. 1, Stepney M.B. No. 2, Stockport C.B. No. 1, Stoke Newington M.B. Nos. 4 and 5, Stourbridge B. No. 1, Stretford B. No. 1, Swinton and Pendlebury B. No. 1, Tipton B. No. 1, Todmorden B. No. 1, Wakefield C.B. No. 1, Wallasey C.B. Nos. 3 and 4, Walsall C.B. Nos. 1 to 3, Wandsworth M.B. Nos. 2 and 3, Wanstead and Woodford B. No. 1, Warrington C.B. No. 1, Wath-upon-Dearne U.D. No. 1, Westminster M.B. No. 3, Wilmslow U.D. No. 4, Wood Green B. Nos. 2 and 3, Woolwich M.B. Nos. 5 and 6, Wortley R.D. Nos. 2 and 3, Yiewsley and West Drayton U.D. No. 1.

SCOTLAND

New Smoke Control Areas in Operation

Nil.

New Orders Confirmed but not yet in Operation

Edinburgh C.B. No. 2, Glasgow C.B. Nos. 2 to 4.

New Orders Submitted for Confirmation but not yet Confirmed

Clydebank B. No. 2, Dumbarton B. No. 2.

Proposals Notified to the Minister

Edinburgh Nos. 3 and 4, Falkirk Nos. 1 and 2, Glasgow No. 5, Kirkcaldy Nos. 1 and 2, Lanark County No. 1, Paisley No. 1, Perth No. 1.

Recommendations on Heights for New Industrial Chimneys

By G. NONHEBEL,
M.A., B.Sc., F.R.I.C., M.I.Chem.E., F.Inst.F.*

A Paper Presented to the Institute of Fuel in London on 23rd May, 1960

Summary. Engineers responsible for the design of new factories are frequently faced with difficulty in deciding the height of chimneys to disperse adequately the discharged gases and residual dust. Under the Clean Air Act, Local Authorities must approve the height of new chimneys. The major consideration is the effect of the discharge at ground level. Formulae have been used for some years for calculating the gas concentration and rate of dust fall under normal weather conditions. From a review of available information, recommendations are now made that the height of a new chimney serving a large plant should be such that the calculated 3-minute maximum concentration of sulphur dioxide at ground level should not exceed 40 parts per hundred million in areas of heavy industry or high housing density and 50 pphm in other areas. Similarly, the calculated maximum rate of deposit of grit and dust from a new chimney should not exceed 1,000 g/100 m^2.month with a wind direction constant within an octant. The formulae proposed are not applicable to emissions from relatively low chinmeys serving small plants; consequently, recommendations based on experience are made for a sliding scale of heights from 60 to 120 ft. for boiler plants of aggregate capacity 5,000 to 33,000 lb./h. Worked examples show that rate of dust deposit rather than ground-level concentration of SO_2 is usually the factor which should control the height of boiler plant chimneys. Prevention of emission of particles or aggregates larger than 76 microns is most important. Additional factors meriting consideration are (*a*) rate of ground coverage by a film of deposited dust ($<0{\cdot}04$ per cent per day suggested), (*b*) distance from the chimney at which dusty plumes become substantially invisible (three chimney heights suggested).

1. INTRODUCTION

ENGINEERS responsible for the installation of new fuel-consuming plant are frequently faced with difficulty in deciding the height of chimney required under the provisions of the Clean Air Act, 1956, as no detailed technical advice has so far been issued by any Government Department. It is, therefore, appropriate to review the present state of knowledge and experience and put forward technical recommendations which could form the basis of discussion between industrialists and those responsible for the administration of the Clean Air Act. In particular cases, consideration of local conditions and circumstances may lead to some modification of these basic recommendations.

2. RELEVANT PROVISIONS OF THE CLEAN AIR ACT

Under Section 10 of the Clean Air Act, Local Authorities must reject plans for a new building which include a new industrial chimney (submitted in accordance with building bye-laws under the Public Health Act, 1936) unless they are satisfied that, having regard to:

(*a*) the purpose of the chimney,
(*b*) the position and description of nearby buildings,
(*c*) the levels of the neighbouring ground,

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* Chemical Engineering Services, Imperial Chemical Industries, Ltd., London; Member of Executive Council, N.S.C.A.

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(*d*) any other matters requiring consideration in the circumstances, its height will be sufficient to prevent, as far as practicable, the smoke, grit, dust or gases from becoming prejudicial to health or a nuisance. This is the only reference in the Act to the control of gaseous emissions. Sulphur dioxide is the gaseous product of combustion to which objection is raised when it is present in the air at ground level in concentrations even less than one part per million. Grit and dust are the subject of Section 6 of the Act, which states that new furnaces for burning pulverized fuel or more than one ton/h of solid fuel shall be provided with grit and dust arrestors approved by the Local Authority, and that the arrestors shall be properly maintained and used.

Sections 6 and 10 of the Act do not apply to premises controlled under the Alkali Act, 1906: these now include public supply power stations and industrial power stations having an aggregate maximum continuous rating greater than 450,000 lb/h steam[1]. Section 10 of the Act does not apply to the County of London, where the L.C.C. have powers under the London Building (Amendment) Act, 1935, to make bye-laws regarding the height of chimneys.

3. GOVERNMENT ADVICE ON CHIMNEY HEIGHT

In a Memorandum to Local Authorities on the Clean Air Act,[2] the Ministry of Housing and Local Government states that guidance on technical considerations governing the height of chimneys is given in Appendix VI of the Beaver Report.[3] This gives general advice on design of chimneys to avoid smoke being carried towards the ground by downwash and downdraught and gives formulae for calculation of the maximum ground-level concentration of the portion of a gaseous discharge which reaches the ground by the process of eddy diffusion; the formulae quoted are from the Sutton[4] diffusion equation for a discharge of cold gas and an empirical formula derived from studies at Oak Ridge, U.S.A., by the U.S. Atomic Energy Commission.[5] Reference is also made to the formula of Bosanquet, Carey and Halton[6] for calculation of the rate of deposit of dust from a chimney discharge. The two latter formulae include the height of the chimney and thermal rise of the plume as parameters.

Neither this Appendix to the Beaver Report nor the Ministry Memorandum gives any indication of acceptable concentrations of sulphur dioxide at ground level, nor of acceptable rates of dust deposit which can be used for calculation of chimney height by means of the above-mentioned or similar formulae.

4. RELATIVE POLLUTION OF CITIES BY SO_2 FROM DOMESTIC AND INDUSTRIAL SOURCES

In most large cities the SO_2 from domestic fires is a greater source of pollution than that from industry. On the assumption that, in winter, domestic fires and industry have an equal output of SO_2, Lucas[7] has estimated, by use of the Sutton diffusion and plume rise equations, that in a large city such as London, industry will contribute only 40 per cent to the long-term average ground-level concentration of SO_2. In conditions of low wind, due to the greater plume rise, the contribution of industry will fall to 30 per cent, though the total concentration at ground level due to domestic fires will increase because of lower atmospheric turbulence.

Although reduction of SO_2 from domestic and commericial buildings is occurring through increased use of gas and electric heating, better insulation and more efficient fires, the only practicable reduction that can at present be obtained in the ground-level concentration of SO_2 emanating from industrial furnaces is by use of higher chimneys to secure greater dispersion of the SO_2 in the atmosphere.

5. EFFECTS OF INVERSION LAYERS

Under ordinary weather conditions,

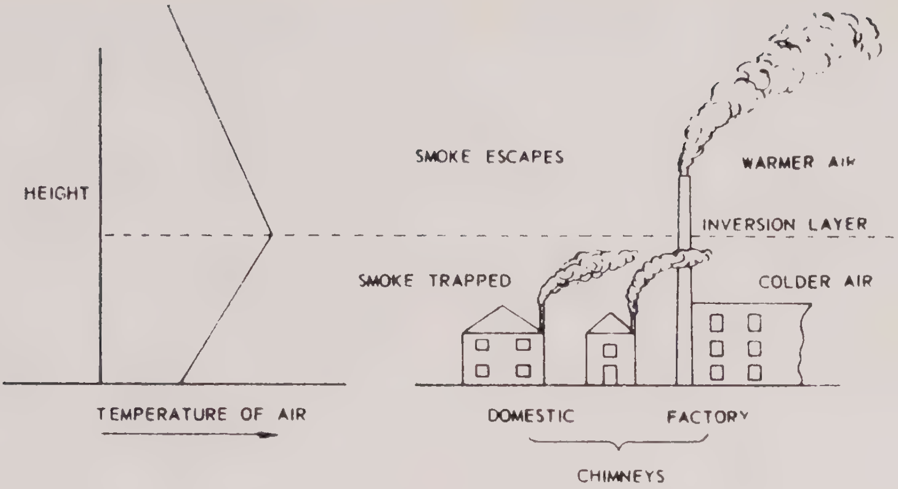

Fig. 1. Effects of inversion layer

the temperature of the atmosphere falls steadily with increase in height. During cloudless evenings and nights, particularly in the autumn and winter, the earth's surface loses heat fairly rapidly by radiation and in consequence the air adjacent to the ground is also cooled. The condition then arises that the air at ground level is at a lower temperature than the air at some height above, though at a still greater height the air temperature again falls with increase in height. This atmospheric condition is known as a temperature inversion; it can occur at any level in the atmosphere, but surface inversions are the most common. The boundary of a surface inversion starts at ground level and rises sometimes quite slowly, often not exceeding a height of 100 ft. by 10 p.m. The initial mixing of warm flue gases with the surrounding air is usually sufficiently rapid to cool them below the temperature of the air above the inversion boundary and consequently they cannot rise further, but are trapped somewhere below the boundary of the inversion layer as shown in Fig. 1. This is the reason for the smoky atmosphere which develops in towns during still evenings. If the air near the ground cools sufficiently to develop fog, the ensuing mixture of smoke and fog is called " smog."

Since industrial chimneys are higher than those of houses, there will be many occasions when the flue gases from them will rise above the relatively low inversion layers which so frequently occur early in the evening.

It follows that for the most part chimneys from which substantial emission ceases after 6 p.m. need not be as high as those used with continuous processes. However, there may be some occasions in winter when a surface inversion persists all day or an inversion layer exists a few hundred feet above the ground On such occasions any substantial discharge from a low-level chimney is to be avoided if at all possible; power to stop chimney emissions from selected factories during (No. 2) smogs of specified intensity is in fact possessed by Los Angeles County, U.S.A.[43]

Power station flue gases can often penetrate inversions which extend to a considerable height. Thus photographs[8] taken above a fog bank have shown that the thermal rise of the large volumes of warm flue gas above chimneys 300 ft. high is sufficient during calm conditions to carry the plumes from power stations through an atmospheric inversion of over 500 ft.*

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* P. J. Meade[9] of the Meteorological Office has commented on these observations as follows: " It has still to be demonstrated that the waste gases also penetrate the inversion layer immediately above the fog and, unless they do, they may be brought to ground level some

6. GENERAL RECOMMENDATIONS ON THE DESIGN OF CHIMNEYS

The following general recommendations apply to all combustion plant irrespective of size.

6.1. Combination of Effluents

Where there are several adjacent furnaces, e.g., a group of boilers, the gases should be combined and discharged through one or two chimneys if this can be done safely. The larger volume of hot gases from the combined effluents rises higher than do discharges from individual chimneys and consequently the concentration of flue gas (including sulphur dioxide) which reaches the ground is smaller (see Appendix 1). Similarly, heat losses from flues and chimneys should be minimized by lagging.

6.2. Avoidance of Downdraughts of Flue Gases

Chimneys should rise sufficiently above adjacent buildings to ensure that the issuing flue gases are not appreciably affected by downdraughts. Where a chimney serving a large plant rises from or is adjacent to a high large building, its height should be at least $2\frac{1}{2}$ times the height of the building. Where there is a choice in the orientation of a long building to which is attached a chimney, the longitudinal axis should be at right angles to the prevailing wind.[11]

When the chimney of a large plant is to be built among a group of high buildings which makes it costly to apply the " $2\frac{1}{2}$ times rule," the only satisfactory solution is to make tests with models in a wind tunnel to determine its minimum height and its position with respect to the buildings. The writer is authorized to state that the D.S.I.R. (National Physical Laboratory) are prepared to consider undertaking, for a fee, wind-tunnel tests in respect of industrial plant proposed for difficult situations.

With small plants, it is seldom economically practicable to follow the $2\frac{1}{2}$ times rule: this difficulty is recognized in Appendix VI of the Beaver Report, where it is stated " Pending further research on the subject, a good working rule for low buildings is to make the chimney not less than 120 ft. high—though discretion must of course be exercised for small installations." No definition was given of a " small installation "; consequently, separate recommendations for small boiler plants are given in Section 7 of this Paper.

6.3. Avoidance of Downwash of Flue Gases along Chimney

The tops of chimneys should be as slender as possible, be free from large overhangs and should not be disguised in towers.

When gases are discharged at a low velocity, part of the gas is drawn into the downdraught on the lee side of a chimney, thus reducing the effective height of discharge. This effect is known as downwash and is the cause of staining the tops of chimneys. American wind-tunnel work, discussed by Hawkins and Nonhebel,[13] indicates that downwash can be prevented by discharging the gases with a velocity twice that of the wind passing the top of the chimney. Since high discharge velocities cause more rapid mixing of the gases with the air with resultant loss of thermal uplift,[15] it follows that the velocity of discharge should be only

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distance from the chimney when the fog disperses by the process known as ' Fumigation.' In a recent paper Spurr[10] has applied various theoretical treatments to demonstrate that the plume from a chimney serving over 800,000 lb./h. of boiler plant (equivalent to a 100-MW power station) will penetrate strong inversions in calm conditions. These theories, however, while forming notable contributions to the problem of the buoyant plume, still remain to be verified and until this is done Spurr's conclusions must be treated with some reserve. Moreover, calm conditions over any appreciable depth of atmosphere rarely occur and even a light wind will bend a plume over and greatly reduce its penetrative power. The problem of the bent-over plume is one of the most important in air pollution and unfortunately one of the most difficult in fluid mechanics."

just sufficient to prevent substantial downwash. Recent tests in a wind tunnel in an I.C.I. laboratory have shown that the bad effects of downwash can be sufficiently avoided by discharging the flue gases with a velocity greater than 1·5 times the wind velocity; such a velocity is sufficient to prevent the centre line of the plume from being drawn below the chimney top.

It is impracticable to achieve the above discharge velocity in relation to very high wind velocities, but the dispersion of the flue gases is increased under such conditions and the loss of effective height is less important.

In practice, the discharge from chimneys serving large water-tube boilers should be 50 to 60 ft. per second and, from smaller plants, a minimum velocity of 25 ft. per second at full load should be adopted when a plant is equipped with induced-draught fans; where the plant has only forced-draught fans, the minimum velocity should be at least 20 ft. per second. No recommendations can be made for plants operating on natural draught because of their inflexibility and it is thought that few such plants will, in future, be erected. It may be noted that most industrial chimneys serving plant with mechanically induced draught are of unnecessarily large diameter.

Downwash is a common occurrence with many existing chimneys. It is therefore suggested that, when chimneys are overhauled, large overhangs might be reduced and consideration also given to increasing the velocity of the exit gas by addition of aerodynamically designed nozzles to the chimney top.[12]

7. RECOMMENDATIONS FOR CHIMNEYS FOR SMALL INDUSTRIAL BOILER PLANTS

A Working Party of technologists (appointed by the Air Pollution Panel of the Federation of British Industries with the author as Chairman) has made a limited survey of the behaviour of " smoke " from the chimneys of relatively small boiler plants to determine chimney heights for those plants which they consider should come within the discretionary limit for " small installations " in the Beaver Committee's reference to a minimum height of 120 ft. for chimneys associated with low buildings (see Section **6.2**). They concluded that the minimum height for the chimney of a new small industrial boiler plant in a built-up area should be 60 ft. to ensure adequate dispersal of flue gases from any solid or liquid fuel and that there should be a sliding scale relating chimney height with size of associated boiler plant—up to 120 ft. for a steam output of 33,000 lb/h. These conclusions apply to cases where the chimney plume is not expected to be seriously affected by downdraughts exerted by neighbouring buildings. For plants of output greater than 33,000 lb/h, the chimney height should be 2½ times the height of any adjacent buildings with a minimum of 120 ft. The sliding scale should be according to Fig. 2 or Table 1; the steps in height given in this table follow steps in the cost of brick chimneys as it becomes necessary to increase the wall thickness at the base.

The slope in Fig. 2 is such that the calculated theoretical maximum ground-level concentration of SO_2 obtained for all the sizes of plant in Table 1 is nearly constant around 10 pphm SO_2 if the gases are discharged from a single chimney, assuming no downdraught and no downwash (see Section **11.4**).

It was also tentatively concluded that total dust and grit content of the flue gases discharged from these small plants should not exceed 0·3 grain/ft^3 at N.T.P. with not more than 0·03 grain/ft^3 of particles greater than 76 microns. These concentrations ensure that the calculated maximum rate of dust deposit is consistent with the limit recommended for large plants, namely 1,000 g/100 m^2.month (see Section **12**). Subsequent study of the calculation sheets (see example, Table 9) has shown the great importance of the quantities of particles larger than 76 microns, particularly those larger than 150 microns. Thus the proposed

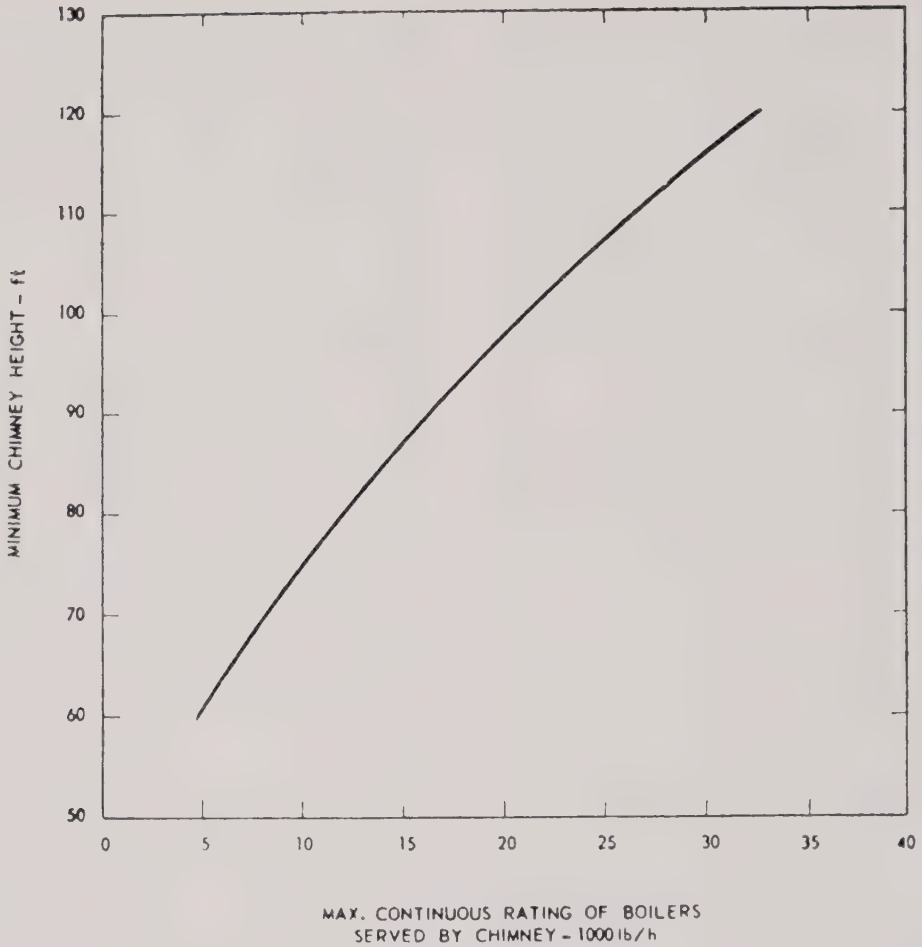

Fig. 2. Recommended heights for chimneys serving small boiler plants

maximum rate of dust deposit of 1,000 g/100 m².month is not met if the emission contains an appreciable proportion of particles larger than 150 microns; on the other hand, the condition is met even if the emission of particles larger than 76 microns is as high as 0·05 grain/ft.³ provided the proportion larger than 150 microns is very small. Unfortunately, there is little reliable information on the size analysis of the over-76 micron fraction escaping the dust arrestors on small plants, partly because of the difficulty of collecting truly representative samples.

The conclusions of the Working Party will not be considered officially by the Federation until this paper has been discussed.

To determine whether the flue gases will be blown to the windows of adjacent buildings, it may be assumed[7] that the gases spread from a virtual point vertically above the chimney within a horizontal cone with a semi-angle of 5°. The height of the virtual point is that to which the centre line of the plume rises (see Section **17.4***).

Table 1. Recommended Height of Chimneys for Small Industrial Boiler Plants

Max. continuous rating of boiler plant (excluding overloads of short duration)	*Minimum chimney height**	*Approx. flue-gas rate at S.T.P. (15° C, 60° F, and 1 atm. pressure)*
—1,000 lb/h steam or million B.t.u./h	—ft.	—1,000 ft.³/min
Up to 5	60	Below 2
5·1–12	80	2–5
12·1–21	100	5–8
21·1–33	120	8–13
Over 33	Over 120 or 2½ times height of adjacent building, whichever is the greater	Over 13

*Some addition should be made to these heights, say 5 to 10 ft., if the velocity of the gases at the chimney mouth is below 20 ft./sec. at maximum continuous rating with the result that downwash may be serious (see Section **6.3**).

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* In Appendix, not reproduced here. See note at end.—*Editor.*

Clearly, the design engineer must exercise some judgment. Thus a chimney may have to be higher if there are many high factory buildings in the neighbourhood or if it is known that local hills cause serious down-currents of air; on the other hand, heights lower than those given in Table 1 might prove satisfactory for installations in open areas well away from existing and planned houses. The F.B.I. Working Party concluded, however, that it was not practicable to develop a points system for addition or subtraction to the chimney height which would be of sufficient value to be generally applicable.

It is believed that these recommendations will improve conditions around factories. The Working Party has, however, suggested that a review of chimneys of heights complying with these recommendations should be made in 1962.

8. CHIMNEYS FOR OFFICE AND OTHER COMMERCIAL BUILDINGS

The heating plant of many large buildings has a flue-gas output equal to that of a small industrial plant; for example, a plant of capacity 5 million B.t.u./h is equivalent to a boiler plant of 5,000 lb/h. Clearly, it is impractical to have a chimney 2½ times the height of a tall office building. The following recomendations should be followed where possible:

(*a*) The chimney should extend at least 10 ft. above the ridge of the building.

(*b*) When a large, high building has a large length to breadth ratio, wind-tunnel tests are desirable to determine the position of the chimney at which the effects of downdraught will be at a minimum in medium to strong winds blowing in the most frequent directions.

(*c*) The velocity of discharge of the flue gases should be high, though care must be taken that the resultant design does not increase noise.

An example of the ill effects of too low a chimney on a large London building is given in Section **11.2**.

9. LIMITATIONS OF FORMULAE FOR CALCULATION OF CHIMNEY HEIGHT

The formulae quoted in the Beaver Report which relate chimney height with ground-level concentration are not valid when the discharge is subject to appreciable downdraught or downwash, but as these disturbances lower the effective height of a chimney, they always increase concentrations at ground level and consequently must be substantially avoided by means indicated in Section **6**.

During the past five years The Institute has held two important discussions[13],[14],[15] on formulae describing the behaviour of chimney discharges. In a paper[14] comparing the value of some formulae, Best wrote: " The ground-level concentration of gas emitted from a chimney reaches a greatest value at a particular distance downwind from the chimney. Both the distance and the concentration itself depend upon the design characteristics of the chimney and upon the meteorological conditions. If the height to which the plume of gas rises above the chimney, owing to heating or velocity of efflux, is known, the maximum concentration likely to occur in any weather conditions can be calculated. It is this maximum concentration which is of interest when the chimney is being designed. Several formulae for computing the height of rise have been published The results of using three of these formulae have been considered and it is shown that, for the purpose of computing maximum ground-level concentration, the three are in reasonable agreement." This latter conclusion was reaffirmed in 1959 by Sir Graham Sutton in a vice-presidential address to the Clean Air Society.[16]

In the discussion of Best's paper, several contributors deprecated further use of the Oak Ridge empirical formula which had been put forward in Appendix VI of the Beaver Report as the best then available for the calculation of ground-level concentrations from chimneys discharging hot gases. It was suggested that, pending further experimental check, the height of rise of a hot plume should be calculated by the theoretical formula of Bosanquet[15] and that, thereafter the concentration of flue gas at points downwind of the maximum height of the plume should be calculated by Sutton's diffusion equation.[4] It was also suggested that plumes rise to a greater height than that deduced from the Bosanquet formula; if this is generally true, there will be some factor of safety in using it for computation of chimney heights. (See also measurements by N. G. Stewart *et al.*[17])

The use of these theoretical formulae has been criticized on the grounds that they are applicable only to average weather conditions and cannot be used when there are unsteady wind conditions or abnormal temperature gradients in the atmosphere; in particular, they cannot be applied during and immediately after an inversion of atmospheric temperature gradient such as that which builds up from the ground during clear autumn and winter evenings when there is little or no wind—conditions which form smog. This criticism has to be placed in perspective or it would lead to deadlock. The designer already knows that he must make chimneys as high as possible and keep their discharge as hot as possible subject to considerations of fuel economy and capital cost. If the chimney height and design are such that pollution at ground level is kept below an acceptable level during all but a few hours of a few days in the year, conditions in our towns will be substantially better than if industrial chimneys are built too low because of lack of information even for normal weather conditions. In terms of *national* economics, the extra cost of higher chimneys to reduce the maximum ground-level concentration of SO_2 and the maximum rate of deposit of dust from a new chimney must be balanced within reason against the cost of loss of amenity and of damage caused by them. Since the cost of a given diameter of high chimney increases substantially with increase in height (by between the square and the 2·5 power of the height approximately, for chimneys between 100 and 400 ft. high), design engineers will prefer to decide on the height of a chimney for a large new plant by calculation backed by experience rather than by guesswork. Special local conditions such as nearby hills, slag tips, etc., may then make it desirable to add somewhat to this calculated height. In order to obtain a single figure for the calculated chimney height, it is necessary to assume fixed conventional meteorological conditions. Those given in Appendix 1 are substantially those used by Hawkins and Nonhebel.[13]

10. RELATION BETWEEN MEAN CONCENTRATIONS OVER VARIOUS INTERVALS OF TIME

The Sutton diffusion formula is based in part on experimental observations having a sampling time of 3 minutes and hence calculations from this formula give time-mean concentrations for 3 minutes. The formula is also based on the assumption that the wind is blowing steadily towards the sampling point during the 3-minute period. This is not generally the case especially in light winds and, because of the tendency of wind to swing about a mean direction, a succession of 3-minute samples taken at one point may give a number of values for the concentration somewhat lower than that given by the formula.

The assumption of a steady wind also becomes progressively less realistic for sampling periods longer than 3 minutes; if longer sampling times are used, for example 15 or 60 minutes, the measured concentrations will be correspondingly lower than those given by the formula. Stewart *et al.*[17] have measured axial concentrations in the plume discharged from a 200-ft. chimney at Harwell and found, for various sampling times between 10 and 30 minutes, that the mean axial concentration was inversely proportional to the 5th root of the time of sampling.

From a study of published data on lateral and vertical diffusion coefficients in steady winds, P. J. Meade[9] has prepared Table 2 which relates calculated concentrations to the duration of sampling at ground level. This table is in broad agreement with the results of Stewart.

During a period of many days, the actual time-mean concentration at a given point will be substantially lower still because the wind does not blow constantly from the same " quarter " —during a year the concentration at any point will be lower than the 3-minute time-mean by a factor of between 30 and 70 depending on the " frequency " of the wind direction.

Table 2. Variation of Calculated Concentration with Duration of Time to which Calculations Refer

Length of time		*Relative calculated time-mean concentration*
3 minutes	. .	1·82
15 minutes	. .	061
1 hour	. .	0·51
3 hours	. .	0·6
24 hours	. .	0·3

In the following sections, consideration will be given to the effects of SO_2 on people and on vegetation. Recuperation from exposure to only 3 minutes of a threshold acceptable concentration may so readily occur that it is justifiable to adjust calculated 3-minute mean concentrations to means for 15 minutes. Also, experience with nauseating smells indicates that people react strongly to exposure to threshold concentrations for more than $\frac{1}{4}$ hour. If, then, a concentration of one unit is the threshold acceptable for exposure for 15 minutes, the concentration given by calculation from Sutton's equation should not exceed 1·2 unit.

11. ACCEPTABLE CALCULATED GROUND-LEVEL CONCENTRATION OF SO_2

11.1 General

The calculated maximum ground-level concentration (g.l.c.) of flue gas, including SO_2 arising from a new industrial chimney discharging products of combustion, should be such that it is neither noticeable nor detrimental to human beings and can be tolerated by ordinary vegetation. Except when combustion is perfect, the SO_2 can also be taken as a " marker " for other objectionable constituents in the flue gas. Consequently, it is not unreasonable to use threshold limits of tolerance of SO_2 for the maximum calculated " g.l.c." for the determination of the height of a new chimney. The SO_2 reaching the ground from the new chimney will, at the position of maximum concentration, increase substantially the local background concentration of SO_2

In the following sections, concentrations of SO_2 have been expressed to two significant figures in order to facilitate the presentation of the information, but in practice the uncertainties of measurements and calculations must be borne in mind.

11.2 Threshold Limit for Human Beings

No information has been published on the threshold limit of SO_2 concentration above which discomfort to human beings occurs in town air—that is air which also contains carbonaceous smoke. The limit for smell of pure SO_2 in absence of smoke is at least 200 pphm[18,19] but it is frequently asserted that lower concentrations can be tasted. An allowable limit that has been suggested[20] in Britain for 8-hour exposure in factory atmospheres of pure SO_2 is 500 pphm and is based on the recommendations of the American Conference of Industrial Hygienists;[21] until 1957 the recommendation was 1,000 pphm.

At the Health Panel of the U.S. Technical Conference on Air Pollution in 1950, Dr. Irving Tabershaw[22] emphasized that the threshold limits for gases in factories were for healthy working adults who were presumed to breathe unpolluted air during 16 hours per day. He suggested that the threshold limit for continuous exposure by the general public, including children and the infirm, should be 10 times lower: if this suggestion is accepted, the threshold limit for continuous exposure of human beings to SO_2 becomes 50 pphm.

There is much qualitative evidence that the effects of SO_2 on human beings are aggravated by town smoke. Thus the Medical Officer for London County Council reports:[23] " Whilst it is difficult to disentangle the effects of duration and intensity of atmospheric pollution and temperature from any seasonal trend, the effect of the smog of January 1956 suggests that the threshold level above which a smog incident is likely to occur in London is when the mean level attains a daily value of 200 milligrammes of black suspended matter per 100 cu. m. of air and 40 pphm of SO_2, i.e., about four times the customary winter level." Smoke is, however, so preponderant that reliable data on the effects of SO_2 in cleaner town air will not be forthcoming until smoke has been reduced further: progress will be steady as a result of the Clean Air Act.

An approximate figure has recently become available for the concentration of SO_2 in London air above which discomfort has been reported. At the beginning of the 1957/58 heating season, the Lancashire boilers of a very large office building in London (Westminster) were changed from coke to oil firing. As a result of the higher SO_2 content of the flue gases in part due to use of less excess air for combustion, serious complaint was made by women occupants of a second-floor office ventilated only from a closed courtyard. The window was 85 ft. below the chimney on the far side of the courtyard. Measurements made in 1958 with D.S.I.R. apparatus gave 127 pphm SO_2 as the highest daily average volumetric concentration when the wind direction was N–NE, the direction to cause downdraught into the courtyard (average of determinations = 77 pphm). After the chimney had been raised from 19 ft. below to 3 ft. above the adjacent 35-ft.-high ridge of the building, the highest daily average concentration fell to 63 pphm (average of determinations when wind E–NE = 36 pphm). Complaint was not made during the 1958/59 heating season, though some of the office workers reported that they were still just aware of the flue gases.

Because the flue gases were trapped in a courtyard surrounded by walls about 70 ft. above the window of the affected office, it is not permissible to use Table 2 to correct the daily average to a higher hourly average. Although the concentration in the courtyard must at times have exceeded the average of 60 pphm, the concentration in the air in the office ventilated from the courtyard would be nearer the average.

A tentative conclusion from these measurements is that discomfort from chimney gases from an oil-fired plant is likely to be reported if the air breathed contains over 60 pphm SO_2 for over 15 minutes; 60 pphm for 15 minutes is equivalent to a calculated maximum concentration of 73 pphm for a sampling time of 3 minutes.

11.3. Threshold Limit for Vegetation

The effect of atmospheric pollution on vegetation is known more precisely. At a British Association meeting in 1953[24] it was concluded that damage to most vegetation and impairment of its growth do not generally occur when the SO_2 concentration is below 50 pphm; certain types of plant are sensitive to lower concentrations, and high relative humidity and temperature have some influence. This figure is also confirmed by workers on the continent of Europe;[25] in particular, Stratmann[26] concludes that the limit for reversible damage by SO_2 is about 1·5 mg SO_2/m^3 (. = 52 pphm) and that damage arising from dust deposition on the leaves of plants is much less important than damage by SO_2.

In a thorough study of the effects of SO_2 on plant life in N. America, where climatic conditions are different from those in Europe, Katz[27] found that young barley leaves were damaged after 8 hours' fumigation by 50 pphm SO_2 and after 30 hours by 30 pphm. The critical concentration below which photosynthesis was unaffected was 50 pphm with lucerne, a plant more sensitive than barley. He concluded, however, that concentrations of 30 pphm may be present in the atmosphere of agricultural areas during the growing season as long as the exposures are not long enough to induce appreciable leaf injury. Concentrations in excess of 50 pphm should be limited to periods of darkness, low humidity and low temperatures. On the other hand, concentrations of 10 to 20 pphm may actually have a beneficial effect on some vegetation.

Hemeon and Hatch [28] at a symposium on Industrial Wastes stated that it is now considered good practice to operate plants producing SO_2 in such a manner as to avoid g.l.c. in excess of 50 to 75 pphm SO_2 because of its capacity for damaging vegetation, allowing the higher limit in areas of heavy industry.

From a detailed study of the above evidence, it is concluded that all but the most sensitive vegetation is unlikely to be damaged by exposure to 50 pphm of SO_2 for periods up to an hour. By reference to Table 2 we see that 50 pphm for one hour is equivalent to an average of 30 pphm during 24 hours, but the corresponding calculated 15-minute time-mean would be just over 65 pphm SO_2.

11.4. Recommendation for Acceptable Ground-level Concentration of SO_2

The conclusion from the preceding sections is that for design purposes the calculated 15-minute average of SO_2 reaching the ground from a new chimney should not raise the total g.l.c. above 50 pphm, taking into account the background concentration. This recommendation allows a margin to cover some of the uncertainties of calculation.

In industrial districts there is already present a background concentration of SO_2 from domestic fires and from other factories. This must be deducted from the allowable calculated concentration from the chimney. The background concentration is measured by many Local Authorities by two forms of apparatus—monthly by the lead peroxide gauge and daily by a volumetric method. As the correlation between the two methods may be in error by a factor of at least 2, only volumetric determinations of SO_2 should be used in determining the maximum g.l.c. from a new chimney.

The arithmetical average of the daily SO_2 determinations for the six places with the highest readings during the winter of 1957 was 17 pphm and the average for the whole country (141 sites, all in towns) was 9 pphm.[29] It is not permissible to use Table 2 to correct these figures to short-period concentrations, since they result from SO_2 emissions from many sources surrounding the sampling points. For chimney design purposes, it is recommended that the mean background concentration in areas of heavy industry or high housing density be taken as 20 pphm and as 10 pphm for all other districts. Considering, therefore, a point on the ground, and assuming that the wind is blowing steadily towards it from the new chimney, the acceptable 15-minute and 3-minute time-mean calculated g.l.c. (to the nearest 5 pphm) are then as given in Table 3.

Table 3. Recommended Maximum Calculated Ground^{4}Level Concentrations of SO_2 under the Plume from a New Chimney

	SO_2—parts per hundred million of air		
District	15-*minute mean* (*specified*)	3-*minute mean calculated from diffusion formula*	24-*hour mean* (*from Table* 2)
Areas of heavy industry or high housing density	30	40	14
All others	40	50	18

In practice, a number of measurements of SO_2 concentration at any one point would not give so high an average as those in Table 3, which are for the worst conditions with a steady wind (see also Section **10**).

Since the wind is constantly swinging even when apparently blowing steadily from one direction, the short-period maximum concentrations occur over a small area which is constantly shifting. Adding the background concentrations, it follows that the daily concentrations in small areas downwind of a new chimney would be increased to a maximum of about 34 and 28 pphm SO_2 in heavily industrialized and other areas respectively.

It is submitted that these concentrations should be acceptable as a basis for determining the height of a chimney until experience over several years indicates what modifications should be made to the suggestions.

Confidence in the calculated figures for maximum g.l.c. of sulphur dioxide is obtained from a few measurements[30] made near eleven British power stations with chimneys ranging from 180 to 450 ft. high; in no case did the maximum exceed 30 pphm with a time of sampling of 3 to 5 minutes. Similarly, measurements with a 10-minute sampling time around a German power station with two chimneys of 500 ft. and one of 350 ft. showed that the maximum g.l.c. of SO_2 generally lay below 18 pphm[31]. In all cases, the g.l.c. calculated from limited information available is consistent with the above measurements.

It must be realized that the above suggestions for design will not reduce the total tonnage of sulphur oxides emitted to the atmosphere over the whole country and, consequently, that part of the sulphur dioxide (a substantial proportion is blown out to sea) will reach the ground by diffusion or in rain. All the sulphur which reaches the ground is quickly converted, in the presence of moisture, to sulphuric acid at great dilution. This is the cause of the corrosion of unprotected steelwork and certain classes of stone used in buildings. On agricultural land the acid is rapidly neutralized by the natural lime content of soil; in areas deficient in lime, the soil becomes "acid" and crops are affected. On cultivated land, crop yields have in many cases been substantially restored by heavy liming of the soil. In general, therefore, the wider the dispersion of SO_2 by means of high chimneys, the lower the damage due to acidity.

11.5. Alkali Inspector's Rules on Chimney Heights

The recommendations given in Section **11.4** may be usefully compared with the present requirements of the Alkali Inspectorate for processes registered under the Alkali Act. "The heights of new chimneys emitting gases containing SO_2 and of chimneys of existing plants on which justifiable complaints have been made are to be not less than those falling on a curve given by the sliding scale in Table 4.[32]

Table 4. Chimney Heights Required by Alkali Inspectorate

Tons SO_2/day ..	30	21	13	7·5	3·6
Minimum height of chimney–ft.	300	250	200	150	100

A minimum height of 120 ft. is suggested as long-term policy for over 0·5 tons SO_2/day. Individual discharge points in any given works are normally to be regarded as one point source; i.e., with three chimneys each discharging 2·5 t/day, each chimney must be 150 ft. high. If the emissions are wet, heights are to be greater. Also, for discharges over 30 t/day, heights above 300 ft. may be required, depending on local circumstances."

The chimney heights given in Table 4 give calculated maximum g.l.c. of about 60 pphm SO_2, assuming a wind speed of 20 ft./sec. and no thermal or velocity rise of the gases. The calculated concentration would be appreciably less if the gases were warm. It is believed that the general aim of the Inspectorate is to ensure that the calculated maximum g.l.c. is below 1 mg/m^3, equivalent to 37 pphm SO_2 at 15° C. (60° F.). It should be noted, furthermore, that some of the gases covered by these requirements may occasionally contain more than 0·3 per cent SO_2 and consequently the instantaneous g.l.c. caused by strong downward eddies might occasionally reach the threshold limit of smell.

The minimum height of 120 ft. is also applied to chimneys carrying discharges from purely chemical operations, e.g., from granulated fertilizer plants. In his Report for 1958 the Chief Alkali Inspector states that complaint has ceased where chimneys from such plants have been raised to 120 ft.

The Alkali Inspectorate's recommendations do not apply to unregistered processes including small boiler plants. It also follows from the recommendations made in this Paper that the sliding scale quoted above should not be applied to the chimneys of power-station-type boilers because the thermal rise of flue gases with such large volumes of hot gas is substantial.

11.6. Action Being Taken by Local Authorities on Chimney Heights

In considering plans for new industrial chimneys, Leeds City Health Department has recently stated that the maximum g.l.c. of SO_2 shall not exceed 30 pphm[33] as calculated by the Sutton formula for cold gas and assuming a wind speed of 9 ft./sec. Similarly, the Public Health Inspector of Coventry[34] has proposed the following maximum allowable concentrations from each chimney calculated for a wind speed of 10 ft./sec. by the Sutton cold gas formula:

Black Area	25 pphm	Areas are classified according to existing background concentration of SO_2
Grey Area	30 pphm	
White Area	35 pphm	

These Local Authorities have not given reasons for the adoption of such low maximum calculated g.l.c. of SO_2. As no account is taken of the thermal and velocity rise of the flue gases, the proposals would be completely impracticable when applied to large industrial or power station boilers.

12. DUST EMISSION AND DEPOSIT

12.1. Recommendation for Calculated Maximum Rate of Dust Deposit

The dispersion of the dust content of gaseous effluents is also dependent on the effective height of the plume. Hence the minimum desirable height for a new chimney can be assessed by comparing the acceptability of the calculated maximum dust-deposition rate with measurements of rates of deposit of solid matter collected in about 1,000 atmospheric pollution deposit gauges used by Local Authorities under the auspices of the Department of Scientific and Industrial Research. Typical figures are given in Table 5.

Table 5. Annual Rates of Deposit of Solid Matter in D.S.I.R. Gauges[35]

	Rate of solid matter deposition†	
Type of District	*g/100 m².month*	*tons/mile².year**
Heavy industrial	1,600–6,400	500–2,000
Cities and light industrial	650–1,300	200–400

* The figures are realistic only when referred to small areas and not to a square mile:

$$1 \text{ ton/mile}^2 = 1{\cdot}16 \text{ oz./100 yd}^2$$
$$= 39{\cdot}2 \text{ g/100 m}^2.$$

† Figures for insoluble matter only: part of some ash emissions is soluble in water.

In Section 7 of their Report, the Beaver Committee wrote: "We are satisfied that the most serious immediate problem to be tackled, is visible pollution by smoke, grit and dust and we have been able to make definite recommendations in regard to these. We must emphasize that the problem is not one which can be solved overnight. Real improvement can be secured only by a continuous programme urgently and insistently carried out over a number of years. The objective of our recommendations is that by the end of 10 to 15 years the total smoke in all heavily populated areas would be reduced by something of the order of 80 per cent . . ."

It follows that the objective of the Beaver Committee would be reached if all new plants were designed to ensure that the calculated maximum rate of deposit of grit and dust on the ground around each new chimney does not exceed over a year more than 20 per cent of the present average for all heavily populated areas, bearing in mind that in the course of time all old plants will be replaced or modernized.

In Table 5 the maximum figure of 6,400 includes one extremely heavy deposit. The average of the six highest deposits of undissolved matter for the year ended March, 1957, is 3,000.[29] The average of the range, 1,600 to 3,000 for heavy industrial districts is 2,300. The objective should be to reduce this figure by 80 per cent, i.e., to about 500 g/100 m^2.month.* From this must be subtracted a reasonable figure for the general deposit rate still likely to occur after the rates from industry have been reduced by 80 per cent over a period of years. Study of the records for deposit gauges on the outskirts of towns over 10 years[36] indicates an average background deposit rate of about 100 g/100 m^2.month, leaving 400 units as the deposit rate from a new chimney which should not be exceeded on any small area. When considering monthly rates of dust deposit, it is necessary to take wind direction into account. Official wind direction records are expressed in terms of time during which the wind blows from each octant of the compass. Since meteorological records indicate that in any one month the proportion of time during which the wind blows within an octant is unlikely to exceed 40 per cent,† the calculated maximum deposit rate from a new chimney should not exceed 1,000 g/100 m^2.month for a wind blowing within an octant. The position will then be:

	g/100 m^2.month
Continuous deposit rate (background)	100
Deposit rate from chimney (1,000 units during 40 per cent of month)	400
Maximum deposit rate at any point around chimney . .	500

It is therefore recommended that the efficiency of a dust arrestor associated with a new industrial chimney should be such that, taking into account the height of the chimney and wind frequency and using the method of Bosanquet *et*[3] *al.*,[6] the calculated maximum rate of deposit of grit and dust from the discharge should not exceed 1,000 g/100 m^2.month for the condition of wind blowing steadily within an octant. It is submitted that this deposit rate should be acceptable as a basis for determining chimney height until experience over several years indicates what modification is necessary.

A simple method of calculation is given in Appendix 1 with the aid of which it is possible to ensure that the combined cost of chimney and dust arrestor is a minimum. It will be found that dust deposit rather than SO_2 at ground level is frequently the factor governing the height of a new chimney. Examination of the worked examples indicates the necessity for substantially preventing, throughout the whole period between overhauls of the dust arrestors, the emission of particles of size greater than 76 microns, i.e., particles defined as "grit" in the Beaver Report and in B.S.2955:1958.[37] In practice, it is possible to arrange for small plants that less than 10 per cent by weight of the escaping dust is larger than 76 microns; substantially better performance can be obtained and is necessary with large plants.

12.2 Regulations on Dust Emission

No Local Authority has up to the

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* Supporting practical evidence is that the deposit rate near the city centre of Leicester (a relatively clean town) was 600 g/100 m^2.month for the year ending 31st March, 1957: the rate averaged 700 in the five years 1949–54.[36]

† This estimate of 40 per cent permits a conservative limit for allowable deposit rate; over a year the prevailing wind does not exceed 30 per cent and is usually lower.

present stated any specific requirements for performance of dust arrestors and related it to height of chimney (see Section **2**). The Alkali Inspector has recently agreed with The Joint Iron Council the minimum heights of chimneys and types of dust arrestor which are acceptable as " provisional best practicable means " for emissions of fume dust and grit from hot-blast cupolas. Minimum chimney heights of 80 and 120 ft. are required according to the size and type of plant.[44]

13. COVERAGE BY DUST DEPOSIT

13.1. The General Case

The rate of deposit of dust by weight is not always a reliable measure of the degree with which it becomes noticeable. Thus a small grit-fall may cause only the slightest inconvenience provided it does not get in the eyes and cause irritation: it is believed that particles below 76 microns would not cause this trouble. The same weight of deposit in the form of one-micron particles would, on the other hand, have a large covering power and would give a noticeable film on the surface on to which it fell.

$$\text{Coverage per day} = 100 \times \frac{\text{Rate of deposit by volume per unit area per day}}{\text{Diameter of deposited particles}} \text{ per cent}$$

where volume rate, area and diameter are expressed in self-consistent units.

The relationship of coverage and dust particle size is more easily visualized by considering the coverage resulting from a given rate of deposit. Thus, if at a given point, the deposition is at the proposed maximum rate (1,000 g/100 m^2.month) and consists entirely of particles of one size d microns, then:

$$\text{Coverage per day} = \frac{25}{d}\%.$$

This is a convenient theoretical conception, but in practice the emitted dust will consist of particles with sizes ranging from <1 micron to >150 microns and at any point the rate of deposit of each size of particle is related to its free-falling speed. Consequently, to determine the coverage due to the varying particle sizes and deposition rates, it is necessary to evaluate equation (1).

$$\text{Coverage per day} = \frac{0{\cdot}05}{\sigma} \sum_{d_{min}}^{d_{max}} \frac{D}{d}\% \qquad (1)$$

where D = rate of deposit of particles size d at position under consideration, g/100 m^2.month (with wind direction constant within an octant);
σ = density of particles (for boiler dust = 2 g/cm^3);
d = average diameter of each size grade of particles, microns.

For grit and dust between 600 μ and 20 μ it is convenient to evaluate equation (1) in conjunction with data expressed in Table 9 of Appendix 1.

For particles having a free-falling speed greater than about 0·1 ft./sec., e.g. for particles of boiler dust larger than about 20 microns:

$$\text{Coverage per day} = \frac{55W}{\sigma H^2} \sum_{d_{min}}^{d_{max}} \frac{\phi . Fr}{d}\% \qquad (2)$$

where $\phi . Fr$ has been evaluated in Table 9 (q.v.);
W = weight of dust emitted, grains/min.;
H = maximum height of plume centre-line, ft. (see Appendix 1).

13.2. Coverage due to Particles > 20μ

Dust particles less than about 20 microns diameter have a negligible free-falling speed (less than 0·1 ft./sec.). Nevertheless, some of this dust will be brought to the ground with the gas plume by normal diffusion processes. Hence this dust will deposit most heavily at the point on the ground where the maximum gas concentration occurs, i.e., at about 10 plume heights from the chimney, the rate being given[13] in practical units by:

$$D_1 = 80 \times 10^3 \times \frac{W_1 f}{u H^2} \text{g/100 m}^2\text{.month} \qquad (3)$$

where D_1 = deposition rate due to particles less than 20 microns diameter, g/100 m^2 .month (with wind direction constant within an octant);

W_1 = weight of particles less than 20 microns diameter emitted from chimney, grains/min. (from flue gas rate in ft.^{3}/min., dust concentration in grains/ft.^{3} and size grading of dust);

f = free-falling speed of particles, ft./sec.;

u = wind speed, ft./sec.

At the foot of Table 9 in Appendix 1 are shown summarized results for the daily coverage due to a deposit of boiler dust of known grading calculated by means of the above equations.

The weights found from equation (3) for the dust deposited due to particles in the range 20 μ to 1 μ are comparatively small, but when these weights and related dust sizes are inserted in equation (1) it will be found the additional coverage adds appreciably to the coverage due to grit and dust above 20 μ.

13.3. Suggested Acceptable Rate of Coverage

Carey[38] has shown that the eye has difficulty in resolving individual dots such as dust particles less than 100 microns diameter, and that coverage of a neutral surface by 0·4 per cent of fine dust is the lowest limit of perception by the unaided eye at a distance of a few feet. He has therefore proposed the hypothesis that if the maximum rate of deposit of dust out-doors does not exceed a coverage of 0·04 per cent per day, it should not give rise to complaints because, on average, there is sufficient rain within every 10-day period to wash away the deposited dust.

If these conditions are to be met, the daily coverage calculated by the means outlined above should not exceed 0·04 per cent at any point. When comparing this proposed maximum coverage with calculated results, due consideration should be given to the directional frequency of the wind; thus the figures shown at the foot of Table 9 are based upon deposition rates, assuming the wind direction constant within an octant, i.e., for the worst conditions.

The hypothesis enunciated above will give the design engineer concerned with emissions of fine dust a further criterion of the suitability of the combination under consideration of dust arrestor and chimney heights.

14. CRITERIA FOR ASSESSMENT OF EFFECTIVE DISSIPATION OF VISIBLE FUMES

The elimination of dark smoke from factory chimneys has resulted in more attention being paid to the appearance of chimney plumes containing dust irrespective of the amount of such dust which may be deposited from such plumes. A theoretical illustration by Stairmand[39] of the relative relationship between the reduction of ground deposit and the reduction of darkness of a plume of dusty flue gas after cleaning by several types of cyclone is given in Table 6: these cyclones do not remove the finest particles of dust.

It is believed that public opinion would not at present take exception to a plume which becomes almost invisible at a distance of three chimney heights under average wind conditions.

In a review of the optical properties of particulate clouds, Green and Lane[40] state that the visibility of a cloud is determined both by the optical properties of the cloud which are related to particle size and concentration, and by the physiological factor of the " threshold contrast " value. Over a large range of brightness the latter may be taken as 2 per cent under average daylight conditions. Pending further study, it may be assumed as a working hypothesis that, at the dis-

Table 6.—Improvement in the Appearance of a Smoke Plume with Better Dust Arrestment

Type of arrestor	*Dust emission as percentage of inlet*	*Calculated maximum dust deposit rate* g/100 m².month*	*Tons of dust deposited per year in circle of 500 yds' radius from chimney*	*Reduction in av. ground deposit rate within 500 yd radius, %*	*Reduction in darkness of plume at mouth of chimney, %*
None	100	60,000 at 70 yd	120	Nil	Nil
Scroll collector	29	270 at 120 ,,	1·8	98·5	19
High-throughput cyclone	19	120 at 300 ,,	0·9	99·2	38
High-efficiency cyclone	9	80 at 240 ,,	0·6	99·5	60
Multi-cyclone	7	40 at 230 ,,	0·3	99·7	65

* For wind of 15 ft./sec. and direction constant within an octant.

tances concerned, the eye is unlikely to notice an expanded plume in which the projected area of the particles in a small section through the centre of the plume is less than 2½ per cent—in other words, that the eye will not readily see a dust cloud which absorbs less than 2½ per cent of the light passing through it. This assumption will not hold for particles smaller than 1 micron because of light-scattering effects.[41] Hence it may be used for boiler dusts, but it may not be applicable to emissions such as the fine fume from oxygen-using steel processes. Nevertheless, this simple hypothesis will enable engineers to give some consideration to the appearance of a plume of dusty gas escaping a dust arrestor using the data already required for consideration of ground coverage by dust which reaches the ground. From limited observations of a plume containing fine dust of known size grading from a p.f.-fired boiler, the hypothesis appears to be confirmed.

The relationship between the concentration and size-analysis of dust in the gas leaving a chimney and its visibility at a short distance from the chimney is given in equation (4), derived in Appendix 2. Assume that an observer standing under the plume and at a distance x' ft. (three chimney heights suggested) from the base of the chimney views vertically a small section through the centre line of the plume. The percentage of light from the sky obscured by the particles in the viewed section, which may be assumed equivalent to the percentage threshold contrast value (specified here as 2½ per cent) is given by:

$$B=\frac{12{\cdot}4W}{\sigma u x'}\sum_{d_{min}}^{d_{max}}\frac{Fr}{d}\% \quad . \quad . \quad (4)$$

where Fr = is fraction by weight of particles between specified size limits whose average diameter is d microns (see Appendix 1, Tables 8 and 9).

Alternatively, the total emission from the chimney which must not be exceeded, if the plume is to become substantially invisible (obscuration = B per cent, by definition) at a distance x' from the base of the chimney is given by:

$$W=\frac{B\sigma u x'}{12{\cdot}4}\sum_{d_{min}}^{d_{max}}\frac{d}{Fr}\% \text{ grains/minute} \quad (5)$$

A worked example is given in Appendix 1, Section **19.**

15. DISCUSSION

It is believed that the recommendations and formulae given in this paper will enable design engineers to decide, for normal weather conditions, on heights of chimneys for boiler plants based on the most reliable information at present available of the effects of sulphur dioxide and dust which are likely to reach ground level by processes of diffusion. The general principles of the recommendations may be applied to emissions from chimneys serving other processes. In all cases it will, however, be necessary for the design engineer to use his judgment in the light of local meteorological or topographical conditions when applying these recommendations. When the dust emitted is composed largely of particles below 5 microns it is also advisable to give consideration to the rate at which the ground is covered by a film of dust and, in large towns, to the appearance of the chimney plumes. A review of the results obtained by following these recommendations should, however, be made after an interval of a few years.

The formulae given are believed to be generally acceptable, though there remains some doubt about the values to be used for the meteorological parameters. It is recommended that the formulae and parameters quoted in this Paper be used pending further guidance by the Meteorological Office.

If the present recommendations prove to be generally acceptable to those concerned with technical and administrative aspects of air pollution, design engineers should find it easier to secure the approval by a Local Authority of the height of a new chimney in their district.

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Note

Mr. Nonhebel's paper is reproduced verbatim (with acknowledgments to the Institute of Fuel), with the exception of the Appendices to which several references are made. The Appendices are included in the preprint of the paper (Institute of Fuel, 3s. 6d. per copy) and will also be included in the final printing in the Institute's journal later this year. Appendix 1 deals with the " Calculation of Height of Chimney to Secure Specified Ground-Level Concentration of SO_2 and Specified Rate of Dust Deposition," and Appendix 2 with " Derivation of Formula for Threshold Visibility of a Dusty Plume."—*Editor*

Electricity in Scotland

Fifth Annual Report and Accounts of the South of Scotland Electricity Board for the year ending December 31st, 1959. H.M.S.O. 4s. 6d. net.

The sales of electricity by the Board increased by 7·4 per cent over those for 1958 to 6,435 million units at an average price of 1·500d. per unit as compared with 1·474d. per unit in the previous year. New consumers numbered 21,000 bringing the total to 1,342,487. Domestic, farm and commercial sales rose by 9·3 and industrial sales by 2·8 per cent. 667 farms were connected and 93 per cent of the farm's in the Board's area are now on supply. 3,811 farms have been connected since the Board was established in 1955.

Trading and income for the year amounted to £41·1 million and the surplus to £94,149, bringing the balance carried forward to £637,334.

The output capacity of the generating plant amounts to 1,656,000 kilowatts, of which 1,534,000 kilowatts is steam and 107,000 and 15,000 kilowatts respectively are contributed by the Galloway and Lanarkshire hydro-electric schemes.

The thermal efficiency of steam generation, excluding the slurry-burning station at Barony, has increased from 24·74 per cent in 1955 to 26·14 per cent in the year under review. The new high pressure station at Kincardine has an efficiency of 32·60 per cent, Portobellow 31·17 per cent, Dalmarnock 29·88 per cent and Braehead 28·54 per cent. Over 60 per cent of the total output was supplied from these four stations.

The maximum demand occurred on January 15th between 17.00 and 17.30 hours and amounted to 1,750,000 kilowatts an increase of 7·56 per cent over 1958. The demand beyond the capacity of the Board's plant was met by imports from the North of Scotland Board of 389,000 units and from the Central Electricity Generating Board of 34,000 units.

The plant extensions during the next seven years, determined after consultation with the North of Scotland Board and the Central Electricity Generating Board includes an additional 120 MW set and two additional 200 MW sets at Kincardine, two 180 MW sets at the nuclear station at Hunterston and two 200 MW extensions at the North of Scotland hydro-electric station at Loch Awe.

Steam stations consumed 3,024,126 tons of coal, all of Scottish origin, 249,617 tons of washery slurry, and 45,860 tons of coke breeze. The average price of coal has risen from 76s. 7d. per ton in 1955 to 93s. 4d. per ton in 1959.

The cost of generation by steam power amounted to ·892d. and by water power to ·256d. per unit.

550 million units were imported from the North of Scotland Board at a cost of 1·776d. per unit, 613 million units from the Central Electricity Generating Board at a cost of ·481d. per unit, 259 million units from the Atomic Energy Authority's station at Chapelcross and 37 million units from other sources at an average cost of ·586d. per unit.

The testing of grit-arresting plants was continued and surveys were carried out in the vicinity of generating stations. Modifications were made to older boilers to reduce smoke emission.

12,651 miles of overhead lines are in operation of which 170 miles are at 275,000 volts and 794 miles are at 132,000 volts. A new design of tower incorporating tubular members has been introduced to improve appearance and reduce cost of construction.

At the end of the year 9,520 consumers were taking off-peak supplies amounting to 225,257 kilowatts and 205 million units. This was distributed between space-heating 151,000 kilowatts, furnaces 31,000 kilowatts, water-heating 15,000 kilowatts, and for other purposes 27,000 kilowatts. 160 schools are now equipped for space heating.

The load factor of the Board's system has increased since 1955 from 43·2 to 46·5 per cent, or excluding off-peak load from 42·8 to 45·1 per cent.

A road-heating installation of 900 kilowatts covering 55,000 square feet has been installed on The Mound, Edinburgh. The installation is automatic, responsive to ground and air frost. The Rugby Union ground at Murrayfield has been equipped with an 1,100 kilowatt heating system laid nine inches below ground.

The staff employed number 12,758 as against 12,269 in 1958.

In matters of research the Board is associated with the programmes of The Electricity Council and the Central Electricity Generating Board, in which matters of particular interest to the Board are included.

Sales of appliances and fittings amounted to £3,923,505 and contracting to £584,688 producing a net profit of £547,836.

A payment of £1·65 million was made to the Secretary of State in lieu of rates, for distribution to local authorities in the South of Scotland.

Expenditure on capital account during the year amounted to £27·4 million of which £16·5 million was in respect of generation, £2·5 million for main transmission, £7·75 million for distribution. Of the expenditure for generation £10·67 million was in respect of Hunterston and £5·45 million in respect of Kincardine.

The Capital commitments of the Board amount to £127,834,518 of which £15 million is 4½ per cent South of Scotland Stock, £51,100,000 advances from the Secretary of State for Scotland, and £57,878,000 loans from The Electricity Council under the Act of 1954.

News from Dunedin

The Dunedin system of diesel engine fault diagnosis and diesel service is making good progress as an answer to inefficient diesel operation, and the instruments concerned are now approved by leading diesel engine manufacturers and are in use in service in over 100 countries.

Diesel Smoke Control, a company associated with Dunedin, now offers a comprehensive fuel injection maintenance service for diesel transport engines using Dunedin equipment. The Managing Director is Mr. D. W. Jaquest, lately Diesel Development Engineer, Bristol Siddeley, Ltd. His important paper—the only one on this problem—to the Society's International Conference last year will be recalled by those who attended.

Clean Air Campaign for Belfast

The Corporation Health Committee has instructed the Town Solicitor to proceed with the question of introducing suitable local legislation for the control of air pollution.

DIVISIONAL ACTIVITIES

The *North West* Division held a successful meeting in February at the works of Radiation Group Sales Ltd., at Warrington. The gathering of over 150 was addressed by Mr. Eric Bellingham, Sales Manager of the Company. The Division also visited the works of Creda Ltd.

On April 13th the *East Midlands* Division met at the Calverton Colliery near Nottingham. The colliery is a new one, production having begun in 1952, and full production of 900,000 tons a year was reached last year. Twenty of the members inspected the workings and coal face and others toured the surface workings. After lunch in the Welfare Club a meeting was held at which Mr. J. Menheniot, Senior Regional Sales Officer, gave an address on the action the Coal Board was taking to stimulate the demand for solid fuel and their action at their own installations to meet the requirements of the Clean Air Act.

Smethwick was the meeting place for the Annual General Meeting of the *West Midlands* Division on April 21st. Councillor F. V. Magness, who is a member of the Clean Air Council, was elected as Chairman and Mr. W. L. Kay, of Smethwick, was elected as Hon. Secretary to succeed Mr. G. W. Farquharson who as previously recorded has now retired. An address, which we record in full in this issue, was given to the members by Mr. McKeown, a Director of the Incandescent Group, Smethwick.

The *Scottish Division* met for its Annual Conference at Aberdeen on May 19th and 20th. After the annual business meeting and welcome by the Lord Provost of Aberdeen the conference opened with an address on " Clean Air: Progress of the New Horizon " by Mr. Arnold Marsh, Director of the Society, a part of which is reported in this issue. Other papers,

A few of the 100 *members of the North West Division who visited the works of Creda Ltd., near Manchester. Extreme right is the Chairman, Mr. S. N. Duguid. On the left is Mrs. Duguid, and behind her, left, is Mr. Hewitson, Divisional Hon. Secretary*

Above are the East Midlands members who visited the Calverton Colliery near Nottingham. To the left of centre are the Deputy Chairman, Councillor Watson of Scunthorpe, Mr. A. Wade, Hon. Secretary, Mr. N. R. Smith, General Manager, No. 6 Area, E. Midland Division, N.C.B., and Mr. Hiller, Chairman of the Division. Below is the smaller party that went down the mine

which it is hoped to report in our next number (the conference took place as we went to Press) were by R. A. Hendries, of Robert Gordon's Technical College, Aberdeen, on the industrial aspects of the Clean Air Act, by Councillor Mrs. Saggar on the domestic aspects, and by Mr. Alexander Steele, City Architect, Edinburgh, on architectural and planning aspects of the air pollution problem.

Although not formally a Division of the Society, the *Bristol and West* Clean Air Committee is a member of the Society and reference may be made here to its meeting at Bath on April 6th. The subject of the meeting was interesting. Criticisms of the Clean Air Act and proposals to establish smoke control areas in Bristol had been made by the Bristol Coal Merchants, Association in press advertisements' and the Committee therefore invited their representatives to attend the meeting to express their views and hear the clean air point of views. Their speakers were Mr. T. L. Silvery, Chairman, and Mr. H. Bartlett, Secretary of the Association, and aspects of the clean air case were put by Mr. Marsh of the N.S.C.A. Mr. Marsh emphasized that not only was a great city like Bristol in urgent need of smoke prevention, but a city like Bath also suffered, particularly from its own domestic smoke, and he had that morning been taking photographs showing the blackening and corrosion of the lovely buildings of the city. (Some reproduced on pages 276, 277).

INDUSTRIAL DUST SUPPRESSION AND COLLECTION

By

C. G. McKeown, A.M.I.H.V.E.

A Paper read at a meeting of the West Midlands Division of the Society at Smethwick on April 21st, 1960

IT is quite impossible in a short paper to cover all the operations and sources in industry that produce dust. I therefore propose to confine my remarks to those aspects of the subject of dust suppression and collection with which I am familiar through research and development as carried out by my company, and from experience in application.

It may be of interest to reflect for a few minutes on the historical significance of these little particles we call dust. As you are aware, from very early in the earth's life there has been atmospheric pollution, what I would call natural pollution, such pollution being caused by winds lifting the dust particles produced by corrosion, erosion, decaying vegetation, etc., and being continually added to by cosmic dusts.

This cycle of dust entrainment and settlement has been going on for millions of years, and it is a sobering thought that this natural phenomena in a segment of time is indirectly responsible for our present day atmospheric pollution. In other words, the dust particles of millions of years ago made possible the rainfall on which the trees and vegetation flourished. The trees finally died to be dug up as coal, and so was born our modern industrial civilization with its uncontrolled discharge into the air we breathe of soot, dust and all the other impurities we know so well. It seems, therefore, a question of like producing like, only the latter state has turned out to be worse than the former. Dr. Blacktin in his book " Dust " deals very fully with these prehistoric and historic dusts.

It is clear that Isaac Newton fully appreciated the far reaching effects of dust when he said " Have not the small particles of bodies certain powers, virtues or forces by which they act at a distance not only upon rays of light for reflecting, refracting and inflecting them, but also upon one another for producing a great part of the phenomena of nature."

Since the Industrial Revolution two fundamental changes have occurred to the atmosphere we breathe. Firstly, there has been a progressive increase in the dust burden or concentration. This applies particularly to cities and industrial centres. Secondly, the physical and chemical characteristics of our present day aerosols are very different to those inhaled by earlier man.

There is very little one can do regarding the latter change, therefore one can say from the health angle that man's respiratory system must, and indeed can, adjust itself to this change.

Be this as it may, I believe the first change, that of concentration, to be the more important factor, and that it is possible to reduce this concentration to a safe and comfortable level.

As you are aware, from the health point of view, the larger dust particles are of no importance. Therefore, it is argued by many learned health authorities, that unless very expensive and complicated plant is used for dust collection, no improvement in health can be expected as a result of the clean air effort.

I do not agree with this assumption. In the first place, as you know, most fumes and smoke tend to flocculate given favourable conditions. Most dusts, on the other hand, do not behave in this manner, but tend to become smaller. It seems to me, therefore, well worth while to collect all dusts, even of large size, on the basis that such dusts, through repeated natural entrainment and settlement, would eventually reach a size that would be dangerous to health. Secondly, I would say that a well designed cyclone is capable of removing a large proportion of dust that would be dangerous to health.

The question is often asked. Assuming that we have to accept some degree of atmospheric pollution, is it of advantage or disadvantage to health that this pollution is of a mixed character? This is indeed what one might call a leading question, and I doubt if any one could give a definite answer. It may be of interest, however, to take an example in this connection. It has been thought for some time that the disease silicosis is brought about by the intake into the lungs of free silica. However, Dr. W. R. Jones, who has carried out a vast amount of research in this field, maintains that the real culprit is sericite. This material belongs to the mica group, and occurs in quite a number of rocks, particularly those rocks that contain a high percentage of free silica.

Dr. Jones has shown that the dust from rocks containing sericite has caused many cases of silicosis, while the dust from rocks containing free silica, but without sericite, have produced very few, if any.

Now it has been found that the rate at which free silica dust particles dissolve is very much retarded if the particles are coated with aluminium. This line of attack has been, and is being, investigated particularly in Canada and America, and it would seem that the spraying of aluminium dust particles into an aerosol containing silica, or silica and sericite, has a beneficial effect.

On balance I would say that a complex atmospheric aerosol with its acid and alkali particles of positive and negative electric charge would be better, from the point of view of health, than a simple acid or alkali aerosol.

Until the advent of the present Clean Air Act, the industrialist was largely only concerned with dust insofar as it affected the environment within the factory. In other words, dust suppression in one form or another was applied to those sources of dust generation likely to be dangerous to health, or causing a nuisance or loss of efficiency. In a large number of cases, the entrained dust was discharged to atmosphere without any attempt at collection, and the attitude was that it didn't much matter what happened to the dust so long as it was " got to Hell " out of the factory. It was only in cases where the dust was of commercial value that serious efforts were made to effect recovery. This may seem a serious condemnation of many industrialists, but I have to admit that in a large number of cases, dust collection was very much regarded as a necessary evil.

Happily the old order is changing, and giving place to new, and industry now realises that in the matter of clean air, its responsibility extends beyond the factory.

Methods

Let us now take a brief look at some of the methods of collection and settlement used in industry.

As you know, every modern dust collection plant comprises the means of inducing gas or air flow within a duct system, also the means for separating the collected dust from its carrying medium before discharging such medium to atmosphere. In other words, in its simplest form, a dust collection plant consists of ducting, a fan, and dust settler. These simple items, however, when joined together, make a complicated whole.

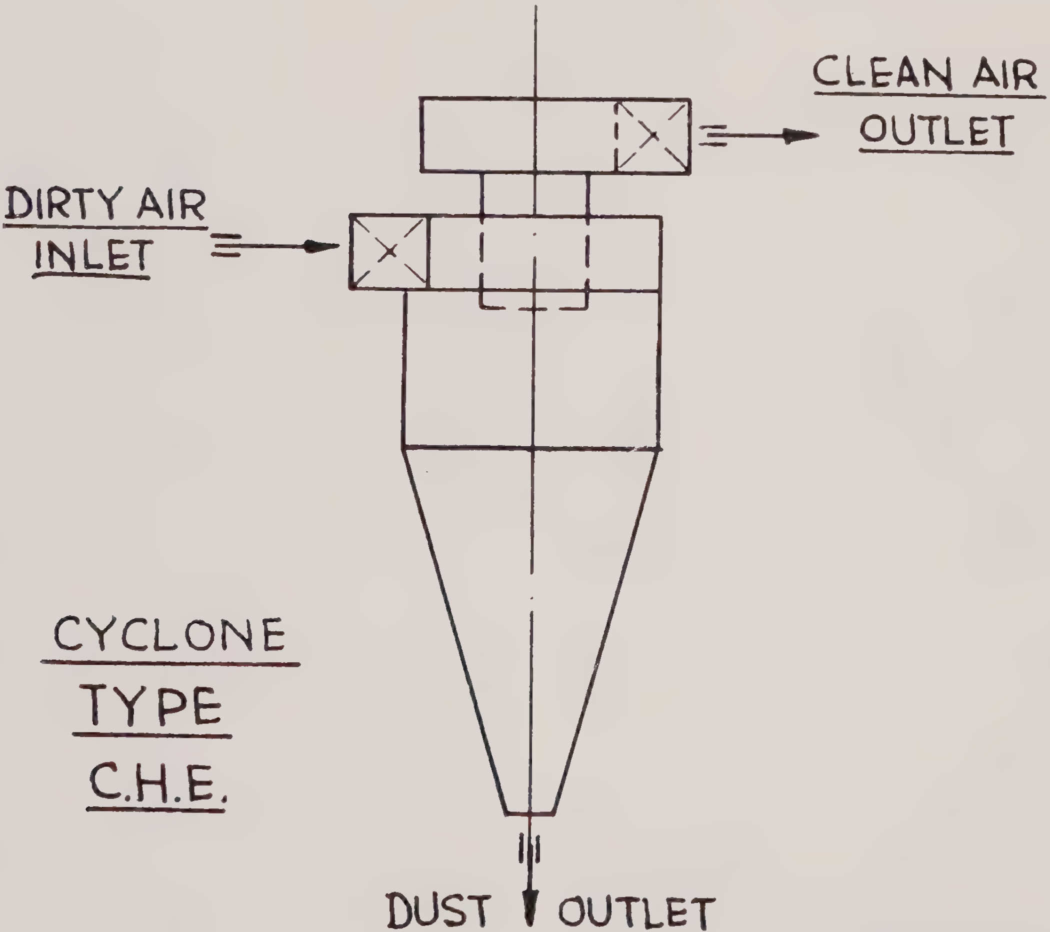
Each dust problem must be considered on its merits. In every case, the source of generation of the dust must be given careful consideration, and it may even be necessary to spend many hours in observation in order to design suitable exhaust equipment. I have in mind such exhaust equipment as is necessary for the removal of lead fumes when making Ledloy Steel. The problem here is not only to trap the fumes but to do so in a manner that will not impede the pouring of the steel.

In designing collecting hoods, it has to be remembered that the fan does not " suck " the dust laden air into the hoods. Indeed, no " work " is done on the air until it enters the fan impellor. In effect, the fan creates a static depression within the suction ducting, and the atmospheric head induces the flow. In view of this consideration, it is necessary to enclose the points of dust generation as closely as possible; this ensures efficient entrainment of the dust particles and reduces the size of the plant to a minimum.

I do not propose in this talk to go into details regarding duct design. Duct sizes, as you know, are determined by the velocity necessary to convey the dust, and these velocities may vary from 2,500 to 4,000 ft. per minute in accordance with the density and dust concentration. When designing a run of ducting, it is important that sharp bends be eliminated, and where possible, all bends should have a radius of throat of two diameters. This proportion gives the lowest resistance for a bend and prevents excessive wear.

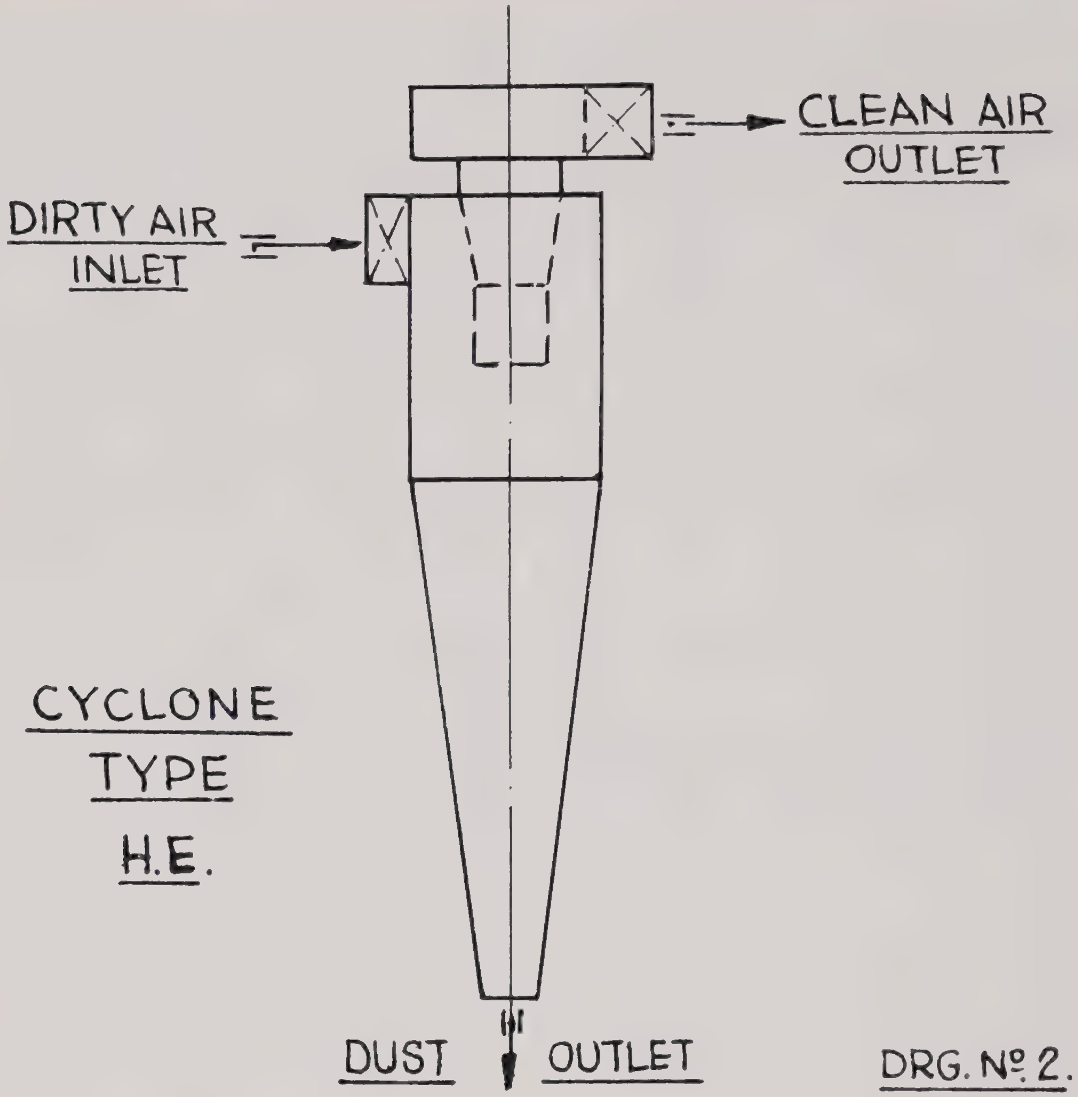
Details such as joints, explosion covers and inspection doors also need careful thought.

Having successfully arranged for the entrainment into the system of the dust laden air, the next problem is the separation of the dust from its carrying medium before discharging such medium to atmosphere. This, in my opinion, is the most difficult part of the proceedings. Every dust, as you are aware, has its own physical characteristics and its density, smallest par-



CYCLONE TYPE C.H.E.

DRG. Nº. 1.



DRG. Nº 2.

ticle size, ph. value, electrical charge etc. must be determined in order to arrive at the type of separator best suited for its collection.

Before describing in detail some types of collectors in common use, I would mention the ph. value and electric charge. The ph. value expresses the strength of acidity or alkalinity of the dust, and it can be taken as a general rule that alkaline dusts are negatively charged, whilst acidic dusts are positively charged.

The Cyclone

The best known form of dust collector is possibly the cyclone. This apparatus, as shown on Drawing 1, consists of a cylindrical upper section with a conical bottom section. The dust laden air enters the cylindrical section by way of a tangentially disposed inlet, and the dust is deposited by means of centrifugal action and gravity. The clean, or partially clean air, escapes through the centrally disposed tube or thimble within the upper section.

The dust outlet should be connected to an air tight dust receiving hopper or to a rotary valve, otherwise the upward vortex within the cyclone causes an induction of atmospheric air at this point and reduces the collection efficiency.

A cyclone of the type described, can operate either on the discharge or suction side of the fan. If the latter application is adopted, and the outlet thimble fitted with a scroll type connection arranged to maintain the initial swirl of the outer vortex, better results are obtained in collection efficiency.

It will be noted that the proportions of the cyclone in Drawing 2 are very different to those shown in Drawing 1. These proportions represent the modern trend in cyclone design for higher efficiency. This development aims at obtaining the maximum separating centrifugal force, such force being inversely proportional to the radius of rotation. The increase in length gives the required extension of time and extra convolutions of the outer vortex necessary to centrifuge the smaller particles.

A still further development is the use of multiples of small diameter long type cyclones, and the makers of these " multi-cyclones " have their own ideas regarding grouping, inlet and outlet positions, and whether the cells should be arranged vertically or horizontally.

In tests carried out on three geometrically similar cyclones of different diameters, with the same batch of dust and similar dust concentration in grains per cubic foot of air, it was found that each cyclone had a maximum efficiency point corresponding to a particular volume. The volume was, of course, different for each cyclone, but what is more important, the pressure drop at maximum efficiency also varied in each case. The smaller cyclone had the higher efficiency, and this decreased with the increase in diameter.

In practice, a compromise has often to be made between efficiency and power consumption, and in many applications in which the dust has no salvage value, collection efficiency is generally sacrificed in favour of lower running costs.

While the humble cyclone has been superseded in the collection of certain types of dust by other forms of collectors, there are still many applications in which it is the only type of plant that can be installed, for example, for the handling of very high temperature dust laden gases.

In this connection, it is interesting to note that the efficiency of any cyclone decreases with the increase in temperature. It is well known that the density of a hot gas is less than that of gas at atmospheric temperature, but unfortunately the viscosity is greater, and consequently the centrifugal force necessary to carry a dust particle to the outer wall of the cyclone in a given time is greater at high temperature than at atmospheric temperature.

This phenomena has been expressed mathematically by Stokes as $F = 6 \pi r \eta \nu$

F = The resistance of the fluid.
r = The radius of the particle (assumed spherical)
η = The co-efficient of viscosity of the fluid
ν = The speed of the particle in relation to the fluid.

From this it will be seen that the force to be exerted upon a particle to force it through a fluid is directly proportional to the viscosity of the fluid.

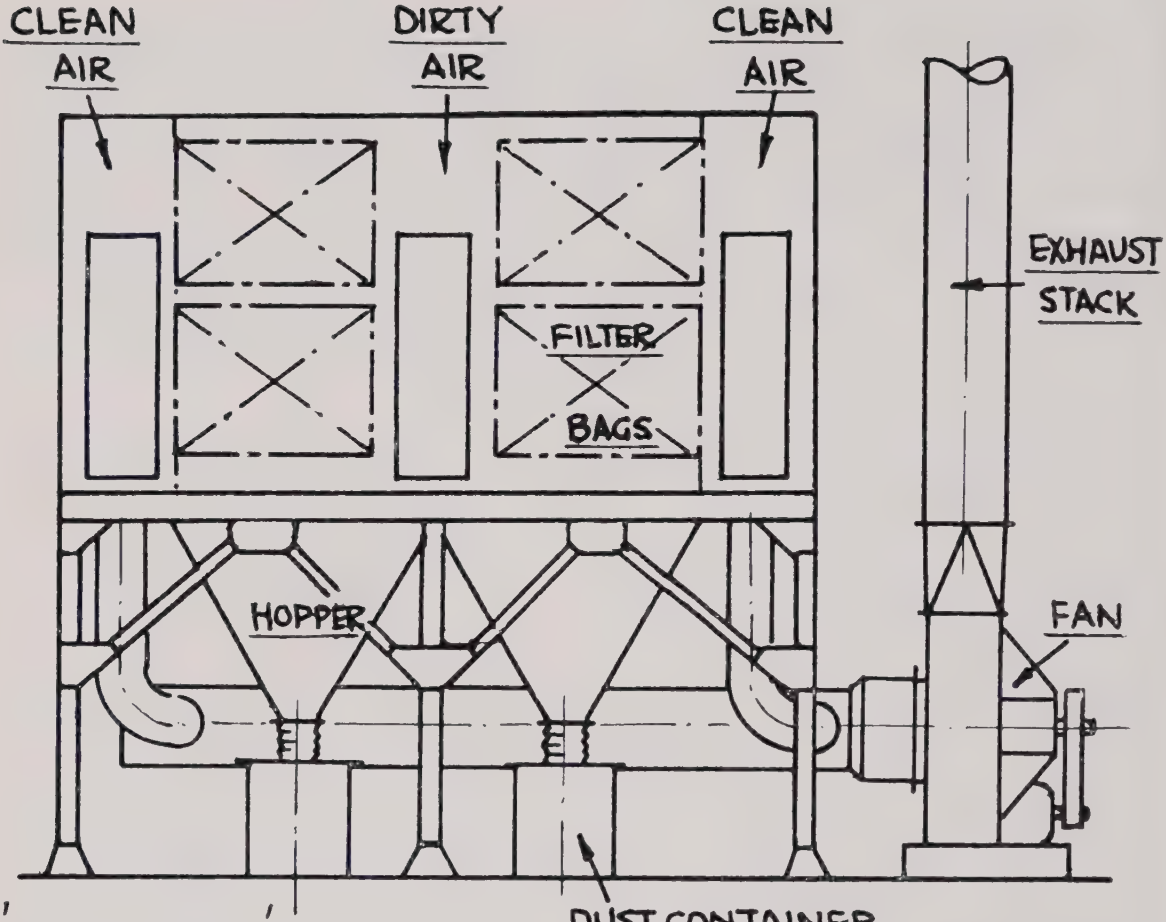
The result of this law on a cyclone handling high temperature gases is to reduce the efficiency by approximately 2½ per cent for each 100°F. rise in temperature.

The small cyclone is still very much in its infancy, and actual performance often falls short of calculated efficiencies. This may be due to disturbing eddies at the walls of the cyclone entraining into the inner vortex a proportion of already separated dust.

I have found that the insertion of water sprays in the air inlet of the common cyclone, produces very little increase in collection efficiency when handling small particle size dust. A marked improvement, however, is noted when the water is replaced by steam, but this innovation is much too costly to be of practical use.

Sleeve Filters

The collection and filtration of dust by means of filter cloth is not new, and such filters consisting of a multiplicity of elongated cloth sleeves, have been in use for many years with varying degrees of success. In this type of filter, the dust laden air is directed into the cloth sleeves and on passing from the interior to the exterior, dust adher



MAX FABRIC FILTER DRG. Nº3.

to the cloth. Hand or mechanized shaking gear is generally provided to free the dust from the cloth, and deposit it in the hopper over which the sleeves are mounted.

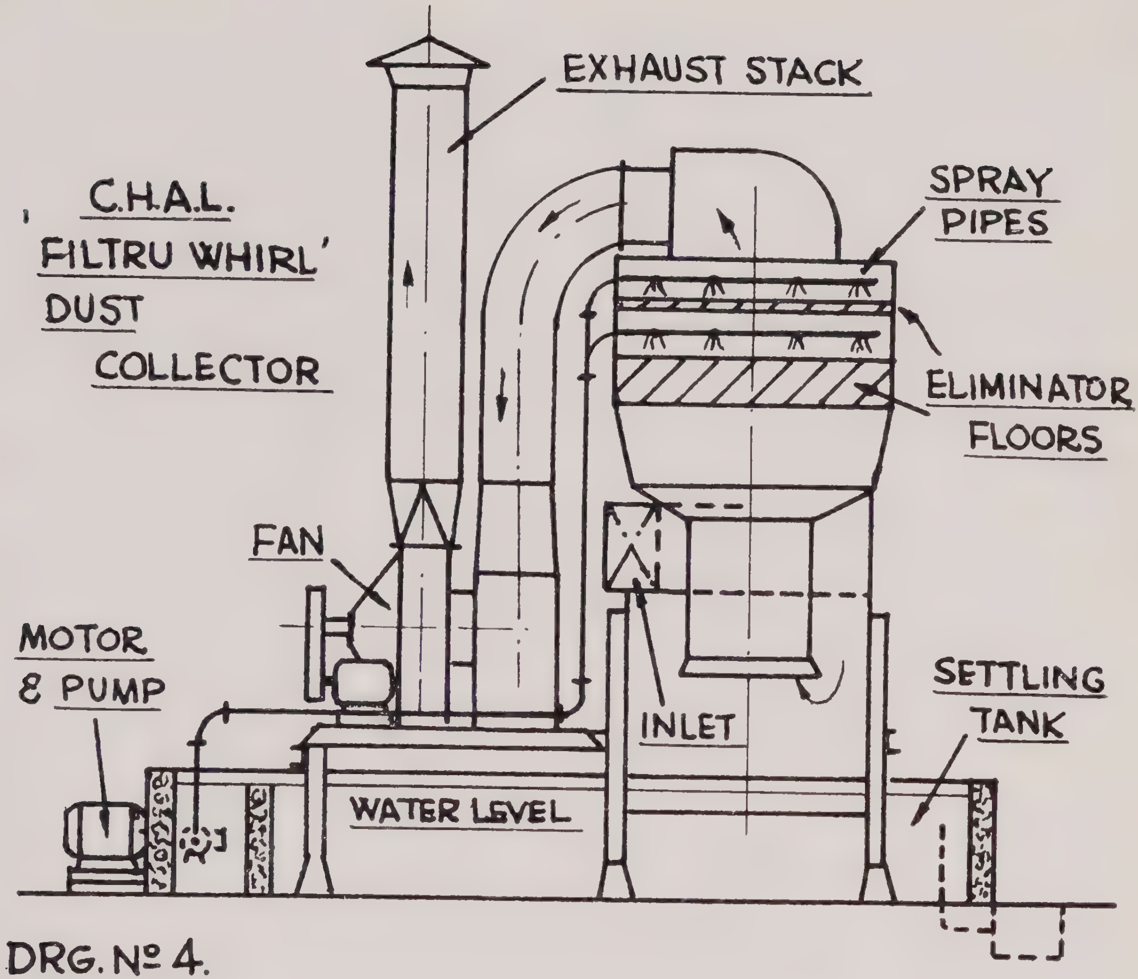
It will be readily appreciated that the volume of air to be handled in conjunction with the type and physical characteristics of the dust, determine the amount of filter cloth to be used. It has been found, in practice, that to obtain really efficient filtration with the sleeve type collector described, a very large amount of floor space is required. This is due to the fact that the circumference of the cloth sleeve only increases in direct proportion to the diameter, whereas the cross sectional area increases as the square of the diameter. In this connection, it should be noted that while it is necessary to design for low air speeds through the filter cloth, it is not essential for efficient filtration to have such low air velocities as obtain within the space enclosed by the cloth in the sleeve type filter.

Much research has been applied to obtaining improvements in fabric filters, and Drawing 3 shows the latest developments in this field. This filter has rectangular filter bags housed in a mild steel casing, these bags being situated equally on each side of a dirty air expansion chamber.

On each side of the filter casing is situated a clean air chamber, and the open ends of the bags are connected to these chambers.

In practice, the dust laden air first enters the expansion chamber, and is drawn from the outside of the bags to the inside rectangular passages communicating with the clean air chambers. The dust is deposited on the outside of each bag and is removed by the action of the reciprocating type shaking gear.

These filters can be supplied for continuous automatic operation, with units of the bags shaken in sequence



DRG. Nº 4.

under the dictates of an electric timer. In addition, a pressure relief damper opens during the shaking period, and this device has not only improved the shaking efficiency but has considerably shortened the shaking period and reduced wear on the bags.

The type of fabric chosen for the bags depends on the physical characteristics of the dust to be collected, and on the temperature of the conveying gas. Cotton bags, for example, should not be used for temperatures above 80°C, while nylon or terylene should not be used for dusts of an explosive nature owing to the static charge that builds up on the bags. It can be taken as a general rule that the static charge is in the reverse ratio to the water regain of the fabric.

The wetting of dust is probably one of the oldest forms of dust control and many methods have been tried in the past to settle and collect dust by means of water or other wetting agents.

Wet Collectors

The evolution of wet type collectors has been extremely slow but modern industrial requirements relating to the collection of dust have given the needed stimulus to research and development. It is now conceded that there is a definite place in industry for an efficient wet collector and in consequence quite a few types are now on the market.

The collector shown on Drawing 4 is of the wet type and is comprised of an upper and lower chamber interconnected by a central tube through which the air or gas and washing liquid can pass. The lower chamber is smaller in diameter than the upper chamber, so that a marked reduction in the velocity of the air or gas occurs immediately the air or gas leaves the central tube and enters the upper chambers.

The upper chamber is arranged with one or more metallurgical coke floors.

These floors consist of $1\frac{1}{2}$ in. metallurgical coke carried on expanded metal, the expanded metal in turn being carried on suitable rolled steel sections welded to the interior of the upper chamber. Spray pipes are located above each coke floor, having connection to a supply pipe feed from a circulating pump which draws its supply from the settling tank beyond a weir located in the tank.

The liquid which is circulated from the settling tank falls by gravity through the metallurgical coke floors in contra-flow to the air or gas. Due to the design of the plant, this liquid on its return passage to the settling tank, forms a curtain between the circumference of the central tube and the surface of the water in the settling tank through which the air or gas must pass in its upward passage to the coke floors.

As will be appreciated from this description, the air or gas on first entering the filter is given a whirling action before coming in contact with the washing liquid, and this whirling action serves to precipitate, due to centrifugal action and gravity, the relatively heavy dust particles into the settling tank, thereby reducing the dust content of the air before coming into contact with the contra-flowing liquid.

Secondly, the air or gas in forming the inner vortex to its passage upwards through the central tube connecting the lower and upper chambers, has to pass through a curtain of washing liquid formed between the circumference of the central tube and the surface of the liquid in the settling tank, thus eliminating the fine size particles of dust not precipitated by centrifugal action and gravity, in the first stage.

Finally, the air or gas has to pass at low velocity through the metallurgical coke floors in the upper chamber, and as these floors are supplied with washing liquid, the air or gas is again brought into intimate contact with the cleansing medium before leaving the collector.

The collector described has been applied to the collection of dust from shot blast rooms, grinding wheels and sand preparation plants, also to dust and fumes dangerous to health or creating a nuisance. It is ideal for the collection of dust from hot gases, and for those dusts that have no salvage value. As the dust is collected in the wet state, a secondary dust problem does not arise when cleaning the collector. This point is very important, particularly when the collected dust contains silica flour, and there is a danger of silicosis.

It should not be assumed that the wet type collector is the answer to all dust collection problems, or even those cases in which it is permissible to collect the dust in a wet state. There are many materials that are very difficult to wet, and this difficulty is accentuated by the absorbed air film when in the dust state. The problem of breaking down this surface air film is largely provided for in a well designed wet filter, but the true wetting of the dust is a physical phenomena, depending on the interfacial tension between the material and the wetting liquid.

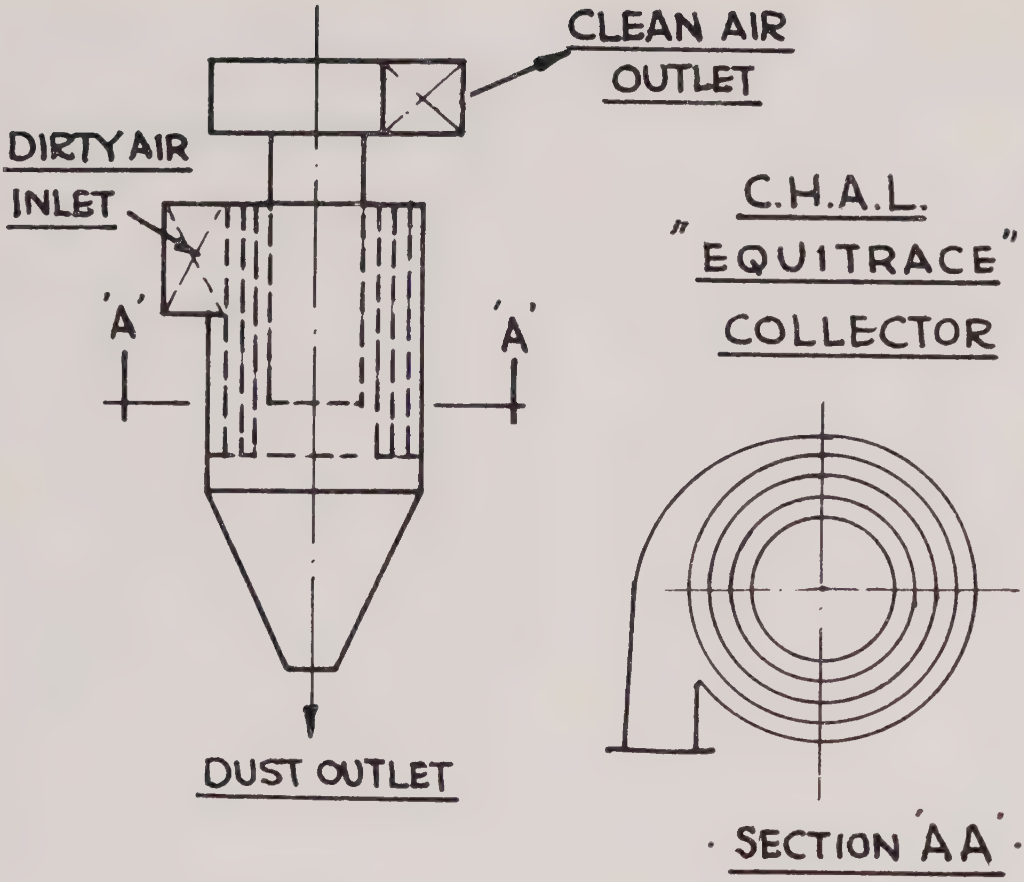
In a liquid, the central molecule is attracted equally in all directions, while a molecule in the surface is attracted inwards.

As a result of this inward pull the surface of a liquid endeavours to assume the smallest possible area, hence the spherical shape of say a droplet of water. It will be appreciated that under these conditions, the surface of the liquid is in a state of tension, and this is known as the surface tension of the liquid.

Water has a greater surface tension than most liquids, but this tension can be greatly reduced by the addition of small quantities of pine oil or other low surface tension liquids. It would appear that this reduction in surface tension of the water is caused by the accumulation of the low tension agent at the interface of the water molecules.

The science of dust wetting is exceedingly complicated and not yet fully understood, and wetting agents, if applied to wet type collectors, should be used with discretion.

It is well known that the surface



DRG. Nº 5.

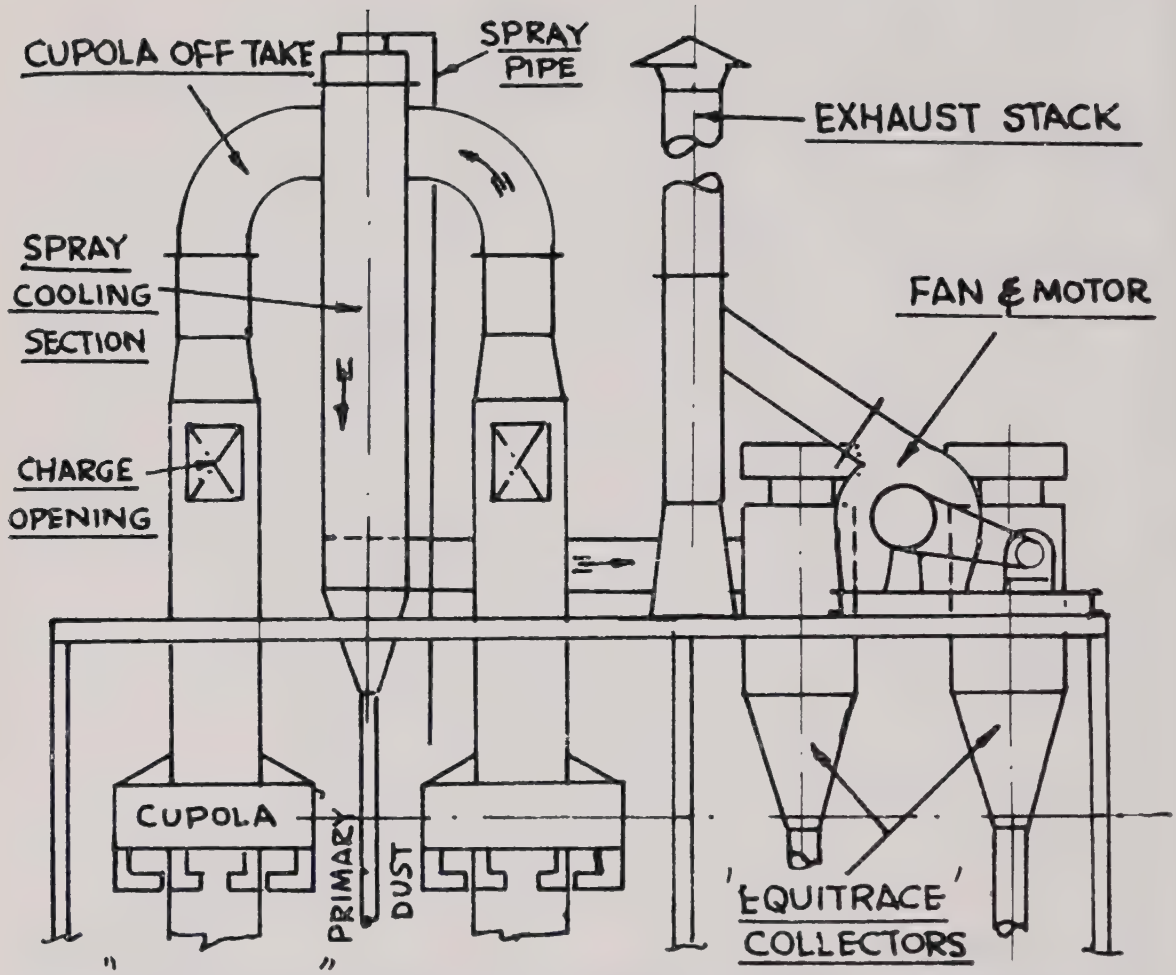
tension of a liquid decreases with increase in temperature, this fact, in addition to gas or air temperature reduction before reaching the fan, makes the wet type collector ideal for the collection of dust from hot air or gas.

In considering the application of a wet type collector, the gas or air carrying the dust should be carefully examined. I have in mind the case of boiler flue gas, this gas is comparatively harmless to metal, but should it be brought into intimate contact with water as in the wet collector, the life of the collector would be very short indeed. This is due to the sulphur trioxide and sulphur dioxide in the gas, combining with the water and forming sulphuric acid ($H_2 SO_4$) and sulphurous acid ($H_2 SO_3$), and both of these acids are very partial to steel.

The dust collection plants already mentioned above have been used for the collection of metallic oxides, carbon black, various chemicals, also sand from shot blast rooms and foundry knock-outs etc., etc.

The " Equitrace "

In conclusion I would like to say a few words regarding the latest developments in the field of wet type collection. As I mentioned earlier, the insertion of water sprays in the air inlet of the common cyclone, produced very little increase in collection efficiency. This was chiefly due to the fact that the water was thrown to the periphery by centrifugal action, and did not come into intimate contact with the air or gas to be cleaned. In order to overcome this difficulty the " Equitrace " collector shown on Drawing No. 6 was developed. This collector contains a multiplicity of concentric tubes positioned between the inner thimble and the outer cylindrical casing, and the design is such that by centrifugal action the heavy dust particles enter



H.E "EQUITRACE" COLLECTION FROM CUPOLAS DRG. No. 6.

the outer spacings, whilst the progressively finer fractions enter the inner spacings. As you know, in centrifugal collection, the smaller the diameter, the higher the efficiency. In principle, therefore, the finer dust particles are collected in the high efficiency sections of the " Equitrace " collector. In addition, water is added to each spacing or channel, but due to boundary walls, this water cannot be thrown to the outer periphery and must, in consequence, effectively clean the layer of air or gas within each well defined channel.

The " Equitrace " collector is ideal for use with hot gases, for, in addition to the cooling and wetting effect obtained, part of the water in these cases is absorbed into the air stream, and we have found that the efficiency of centrifugal collection is higher with a moisture laden gas than with a dry gas.

You are all familiar with the wet collectors used on cupolas, but unfortunately this type of collector is not acceptable for hot blast cupolas. I feel, however, that the " Equitrace " collector is the answer to this problem, and Drawing No. 6 shows two hot blast Cupolas arranged with " Equitrace " collectors.

I have attempted to cover a very wide field in a short space of time, and I only hope that perhaps a little of what I have said has been of interest to you.

Coal Utilization Council.—Mr. Williams has resigned as Director of the C.U.C. to become a deputy Director-General of Marketing at the National Coal Board. He has been succeeded by Sir Campbell Hardy, K.C.B., C.B.E., D.S.O.

A Hundred Years Ago

The *Proceedings* of the Institution of Civil Engineers for May 1960, quotes from a paper read to the Institution on 1st May, 1860, by Mr. D. K. Clark, on "Coal Burning and Feedwater Heating in Locomotive Engines." The author said:

> "The general abandonment of coke as fuel in railway engines, and the use of the combustible in its normal condition as coal, will, probably, in the course of a few years, become an accomplished fact, as the change is now rapidly taking place. The immediate motive for it, is the necessity for reducing the expenditure on railways, in order to increase the dividends. As the cost of coke is, necessarily, greater than that of coal, and inasmuch as, with proper management, a pound of coal does as much duty as a pound of coke—occasionally, rather more, the whole difference in cost of the two descriptions of fuel is economized. But there is the nuisance of smoke to contend with, on the railways using coal, when the coal is not completely burned and the smoke is not prevented, particularly in running without the blast, and in waiting at stations. The term ‘smoke Nuisance’ has only a relative signification dependent on the views and tastes of railway travellers, and of the public generally, but the term ‘smoke prevention’ has an absolute meaning, and those systems by which smoke is entirely prevented, must be considered the best."

Fog Contrasts

What better vindication could there be of Bolton's smokeless zone than Saturday morning? Traffic was approaching Bolton with fog lights and side lights switched on; people from the suburbs, from the Haulgh to Astley Bridge, arrived muffled up in scarves, with reports of visibility down to about 10 yards. And, suddenly, they reached the town centre and found it comparatively clear. By 10.30 a.m., while reports of dense fog around Bolton were coming into this office, the sun was shining over Deansgate and Bradshawgate.—*Bolton Evening News, February 8th*, 1960.

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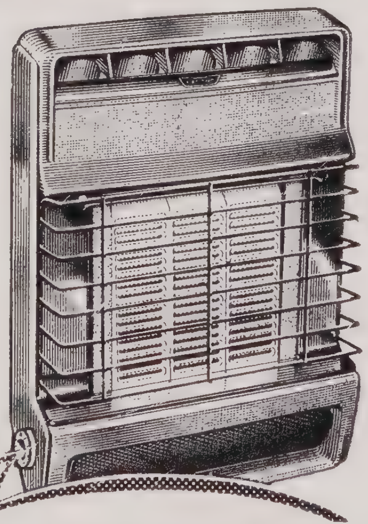

AIR POLLUTION ABSTRACTS

442. Aromatic Polycyclic Hydrocarbons in Polluted Air as Indicators of Carcinogenic Hazards. Falk, H. L. et al. (Int. J. Air Poll. **2,** 201-209, Mar. 1960). Biological assay is the best method for evaluating the carcinogenic risk involved in breathing polluted air; yet the lengthy procedure and other factors involved preclude its use. Consequently, the concentration of 3,4-benzpyrene in air samples is used as an indicator of carcinogenic risks, and rapid and reliable methods for the determination of benzpyrene have been worked out. There remain, however, two obvious shortcomings in this approach. First, polluted air frequently contains substances other than the polycyclic aromatic hydrocarbons which will produce cancer. Second, there is no accounting for other effects of polluted air. These effects, although not carcinogenic, may enhance the carcinogenic process by inhibiting the normal physiologic process by which foreign materials are eliminated from the lung. The slowing and cessation of the mucous flow in the lung are the result of irritants such as automobile exhaust. The conditions under which quantitation of 3,4-benzpyrene in air samples are carried out in the laboratory may be far different from those existing in the lung. Some of the effects resulting from these differences are described. A chemical method for the evaluation of the carcinogenic potency of polluted air requires determination of all polycyclic aromatic hydrocarbons elutable by protein solutions. (Shortened Abstract).

443. Fluorescent Spectra of Aromatic Hydrocarbons Found in Polluted Atmosphere. Thomas, J. F. et al. (Int. J. Air Poll. **2,** 210-220, Mar. 1960). Fluorescent spectrometry offers a very sensitive method of both qualitative and quantitative analysis as, in comparison with other types of spectral analysis, only very small quantities of material are required. The purpose of the paper is threefold: (1) to present a method for obtaining smooth fluorescent curves directly from paper chromatograms; (2) to exemplify the limitations inherent in fluorescent analysis, both qualitative and quantitative; (3) to show smooth fluorescent curves of compounds obtained from polluted atmospheres and compare them with those of compounds of known composition.

444. Polynuclear Aromatic Hydrocarbons in the Particulates of Diesel Exhausts in Railway Tunnels and in the Particulates of an Urban Atmosphere. Moore, G. E. and Katz, M. (Int. J. Air Poll. **2,** 221-235, Mar. 1960). This paper describes work on the identification of polynuclear aromatic hydrocarbons in the particulate matter arising from the operation of heavy diesel locomotives in railway tunnels, and includes a comparison of results with those derived from a similar analysis of particulates collected from an urban atmosphere. The results indicate that, although the operation of diesels in the tunnels increased the particulate loading of the tunnel atmospheres to some eight times the loading of the general urban atmosphere, the detectable amounts of polynuclear aromatic hydrocarbons were such as might be found in the particulates carried into the tunnel by ventilating air. No hydrocarbons were found in the tunnel particulates which were not found in the particulates collected at the top of a ten storey building adjacent to one of the tunnels, and it is concluded that the production of polynuclear aromatic hydrocarbons in the cylinders of efficiently operated diesel locomotives is negligible in comparison with the formation of this group of hydrocarbons by general combustion of fuels in urban activities.

The methods used were chromatographic and spectrophotometric, and included fractionation of benzene extractable organic fractions into aliphatic, aromatic and oxygenated groups on silica gel columns, the further chromatography of aromatic groups on alumina, identification of hydrocarbon species by comparison of analytical spectrograms with published ultraviolet spectra and spectra of reference samples, and quantitative estimation of concentrations by the base line technique.

Polynulear aromatic hydrocarbons identified in urban air samples were fluorine, anthracene, pyrene, fluoranthene, 1,2-benzanthracene, 3,4-benzpyrene, 1,2-benzperylene and coronene. Spectograms for tunnel samples showed in some cases small peaks which were characteristic of some of these hydrocarbons, and in other cases only suggestive shoulders or inflections.

445. Chromatography of polycyclic hydrocarbons, The. Dubois, L. et al. (Int.

J. Air Poll. **2,** 236-252, Mar. 1960). A scheme of analysis is presented for pure polycyclic hydrocarbons and extracts of these as found in airborne particulate matter. This is based on preliminary separations of solutions or extracts on columns of deactivated alumina, followed by paper chromatographic separations of individual fractions. For optimum separations the use of acetylated paper has been found essential. Paper chromatography is carried out by the ascending technique as described.

The run is stopped when the solvent front has travelled perhaps 35 cm., and the chromatograms are air dried in an air-conditioned darkroom at constant temperature. The dried paper chromatograms are inspected in the dark under ultra violet light. Zones may be outlined with pencil and R_f values determined. Note is made of the characteristic colour of the zones under ultra violet light. Duplicate chromatograms may be sprayed with colour developing reagents.

From the R_f values and colours of the sprayed and unsprayed chromatograms preliminary identification can be made. Identification becomes more positive by using ultra violet absorption spectroscopy and ultra violet fluorescence spectroscopy. These techniques are performed on individual spots while still on the paper.

Our experience indicates that separations should be complete before attempting identifications. Separations on acetylated paper are much better than on alumina, although the capacity of paper is much more limited. Certain separations may be made on paper which are practically impossible on a column.

Paper chromatography of the commercially available reagent grades of polycyclic hydrocarbons shows that very few are of adequate purity. It is necessary for workers in this field to purify suitable reagents, preferably to chromatographic standards. Some discrepancies between ourselves and those of other workers with respect to R_f values, colours, etc., may be attributed to materials of uncertain composition.

Reproducibility of R_f values has not been entirely satisfactory. Variation may be as high as ±0·03 R_f units. This lack of reproducibility we believe to be mostly due to variability in the acetyl content of the paper used, from sheet to sheet, and within the sheet. We do find R_f values, however, much more reproducible than R_B values. This is related, in our experience, to the greater variability of the R_f of 3,4-benzpyrene as compared with other hydrocarbons. With almost no exceptions, however, the sequence of separation of a particular group of polycyclics is always the same for a fixed set of operating conditions.

446. Ultraviolet, Visible and Fluorescence Spectral Analysis of Polynuclear Hydrocarbons. Sawicki, E. et al. (Int. J. Air Poll. **2,** 253-272, Mar. 1960). A novel approach to the analyses of polynuclear hydrocarbons in mixtures is introduced. On the basis of this approach a new simple, sensitive and specific test for benzo[*a*]pyrene has been developed. In a mixture of fifty compounds containing benzene, naphthalene, anthracene, phenanthrene, benz[*a*]anthracene, benzo[*c*]phenanthrene, chrysene, pyrene, benzo[*k*]fluoranthene, benzo[*e*]pyrene, perylene, benzo[*g*,*h*,*i*]perylene, anthanthrene and coronene, benzo[*a*]pyrene can be identified unequivolally. The ultraviolet-visible, activation, and fluorescence spectra in pentane of a large number of polynuclear hydrocarbons are presented. The fluorescence intensities of the different hydrocarbons are compared. Some, like anthanthrene and perylene, have an extremely high intensity, which simplifies their detection in a mixture. The sensitivity of the fluorometric methods are of the order of millimicrograms per milliliter, or parts per billion. From a comparison of the activation spectra in pentane and sulphuric acid of different hydrocarbons, it can be ascertained whether a given hydrocarbon can be determined in the presence of hydrocarbons of somewhat similar structure. In many instances it is possible to obtain the pure fluorescence spectrum of an aromatic hydrocarbon by determining the spectrum of the mixture at an appropriate activation wavelength maximum of the aromatic hydrocarbon. Thus benzo[*e*]pyrene can be determined in the presence of benzo[*a*]pyrene, and vice versa. Perylene or anthanthrene can be detected readily in a complicate mixture of some twenty-five analogus hydrocarbons. Naphtho[2,3-*a*]pyrene can be detected in a mixture of fifty polynuclear hydrocarbons. Many other possibilities are apparent from an examination of the activation spectra of the hydrocarbons. The quenching effect of a fairly high concentration of miscellaneous compounds in a mixture as it affects fluorometric analysis for some particular hydrocarbons is also discussed.

447. Detection and Determination of Polynuclear Hydrocarbons in Urban Airborne Particulates—1. The Benzopyrene

Fraction. Sawicki, E. et al. (Int. J. Air Poll. **2,** 273-282, Mar. 1960). A new simple procedure for the determination of benzo[*a*]pyrene in complex mixtures is introduced. A comparison of the concentration of benzo[*a*]pyrene in the air of nine cities for the month of November, 1958, is given. Evidence is presented for the identification of each hydrocarbon found in the benzopyrene fraction. The relative contraction of benzo[*a*]pyrene, benzo[*e*] pyreze, benzo[*k*]fluoranthene and perylene in the nine cities is approximately constant.

448. Polarographic Properties of Smog Aerosols. Mayrsohn, H. and Mader, P. P. (Int. J. Air Poll. **2,** 283-290, Mar. 1960). Based upon observations that atmospheric aerosols collected on filter papers exhibited oxidant properties, it seemed reasonable to expect that these aerosols would be electro-reducible, hence capable of rapid and precise analysis with the polarograph and dropping mercury electrode. Under the described experimental polarographic conditions, atmospheric aerosols yielded a simple, stable and consistent voltage pattern consisting of not more than two half-wave potential values, regardless of the geographical source of the sample. One wave was identified as due to lead ions. The second wave which was always present in samples taken during smog episodes, was not definitely identified, but is apparently associated with $(NO)_x$ olefin reaction products. It was found that the aerosols resulting from automobile exhaust yielded polarograms strikingly similar to atmospheric aerosols and that the resultant diffusion current was a function of the olefin content of the original fuel.

449. Correction for Anisokinetic Sampling of Gas-borne Dust Particles. Badzioch, S. (J. Inst. Fuel **33,** 106-110, Mar. 1960). A representative sample of dust can be obtained from a dust-laden gas stream only if sampling is isokinetic. An expression is given for the effect of anisokinetic sampling upon the relative quantity of dust entering the sampling nozzle. Two methods of calculating the dust concentration are considered and a criterion is provided for deciding, under the particular sampling conditions, which method gives the closer approximation to the true dust concentration. Procedures are given for determining the true concentration and true size distribution of dust from a sample collected anisokinetically. Finally, sampling at a fixed velocity is considered. In the case of very fine or very coarse particles the errors arising from sampling at a fixed velocity, irrespective of the value of the gas velocity, are small providing the appropriate method of calculation is employed.

450. Reduction of Smoke from a Vertical Boiler Fired by an Underfeed Stoker. Bailey, D. L. R. and Reed, L. E. (J. Inst. Fuel **33,** 188-192, April, 1960). A series of tests has been made to measure the smoke emitted under different conditions of operation from a vertical boiler fired by an underfeed stoker. The density of smoke was affected both by the quantity of air supplied and by the method in which it entered the combustion chamber. The introduction of secondary air either through the boiler door or through the back of the boiler was found to reduce the emission of smoke, but the minimum quantity of smoke was produced when using modulated control of both the rate of coal feed and the quantity of primary air. This latter method was found to be the most suitable to meet the requirements of the Clean Air Act.

The Market for Coal. Planning Broadsheet No. 439, Political and Economic Planning, London, February 1960. pp. 62. 3s. net.

This survey of the marketing problems facing, or approaching, the coal industry in Britain is a careful and reasoned study of the quality expected from P.E.P. From the clean air viewpoint the survey is helpful, especially on the industrial side, though necessarily brief. " The Clean Air Act has been thought by many," says the broadsheet, " to have prejudiced the position of coal in the industrial market. But here again there is an answer. Mechanical stokers, properly installed and operated, can keep smoke emission well within the limits set by the Act." And: " An essential part of the service rendered to consumers by the Coal Board and distributors must consist of advice on how to burn coal efficiently and thus at one and the same time to get the most out of the coal and reduce the pollution in the atmosphere."

On the domestic side, with particular reference to smoke control areas and their effect on the coal market, the facts are stated fairly, but the view about the expansion of solid smokeless fuel production seems to be less optimistic than the more detailed inquiry made by the Committee on Solid Smokeless Fuels which is reviewed elsewhere in this issue. While rightly stressing the coal industry's need to improve its service to consumers and to publicize the more efficient ways of using coal, there is an acceptance of the " cosy coal fire " publicity which, although it may have a short-term value for coal, is essentially contradictory to the " new look " image that should be created for coal. There is, however, a reference to the industry's need to hold the consumer to solid fuel until smokeless fuel production has been considerably expanded.

Quality, service, reduction of cost to the consumer, and publicity are given as the four objectives which if " energetically pursued by the Coal Board and supported as necessary by the coal trade and appliance manufacturers " will mean that " the period ahead should be a good deal more stable for coal than the period just past."

ELECTRIC FIRELIGHTER

Experiments with electric firelighters have been reported for many years past. Some were reasonably effective but have been rather bulky and not satisfactory with smokeless fuel. A device that has to be inserted in the fire, like a gas poker, has the obvious disadvantage of being damaged if left in too long. There is now a real need for a device to ignite smokeless fuels, especially where gas is not available or where, for any reason, the householder may not wish to use gas. Such a device would also help to settle the question of whether to allow the use of wood and paper for ignition (about which, behind the scenes, there has been much discussion of late).

Two manufacturers have been giving the matter their attention for the past few months and prototypes of two ignition devices have been tried out in various parts of the country.

Both manufacturers have worked on the same lines, using hot air as the means for ignition. The principle is similar to that of a hair dryer but of course the temperature is very much higher. Tests have been carried out with various fuels and very satisfactory times are said to have been achieved with fuels suitable for burning in open grates. Selling prices have not been fixed but are not anticipated to be unreasonable, especially as it will be possible to ignite several fires for 1d., the actual number being of course dependent on the type of fuel being used.

One of the electric firelighters being demonstrated

CLEAN AIR ACT CASES

Section 1—Hayes & Harlington

Proceedings were taken on April 14th by the Council against Messrs. Horsley Smith and Co. (Hayes) Ltd., Flooring Specialists, (*a*) for emitting black smoke in excess of the limits laid down by the Dark Smoke (Permitted Periods) Regulations in contravention of Section 1 of the Act and (*b*) for installing a furnace which was not capable of operating continuously without emitting smoke in contravention of Section 3 of the Act.

The defendants were represented by Counsel who entered a plea of guilty in each case. In mitigation it was stated that the furnace, which used scrap wood from the defendants' wood-block flooring factory, had now been improved and was operating satisfactorily. A fine of £5 in each case was imposed and £6 6s. costs were awarded to the Council.

Section 1—Stockport

On February 24th the Fine Spinners and Doublers Ltd., Manchester, were fined £2 for a black smoke emission of 3 minutes from their Wear Mill at Stockport.

For the Company it was stated that they had a number of mills in the North-West and this was the first time they had been prosecuted for a smoke offence. The week previous to the offence a load of washed slack had been delivered to the mill, which was not the usual type of fuel. The stoker had omitted to adjust his dampers so that there was a lack of primary air to the fire-bed, which was the cause of the black smoke emission.

Section 1—Huddersfield

The following are particulars of cases heard before Huddersfield Magistrates Courts:

Moorhouse & Brook Ltd.: For 15 minutes continuous emission of dark smoke. Pleaded guilty. Fined £5.

James Haigh Ltd.: For 25 minutes emission of black smoke (which included 22½ minutes continuous emission) and 15 minutes dark smoke (which included 6½ minutes continuous emission) in a total period of 50 minutes. Pleaded not guilty and submitted defence under Section 2. Magistrates found the case proved. Fined £5.

Shaw Bros. Ltd.: For 10 minutes continuous emission of dark smoke. Pleaded not guilty and submitted defence under Section 2. Magistrates found the case proved. Fined £5.

John Haigh & Sons Ltd.: For 6 minutes continuous emission of black smoke. Pleaded guilty. Fined £10.

Sykes & Tunnicliffe Ltd.: For 9 minutes emission of dark smoke (which included 7½ minutes continuous emission). Pleaded guilty. Fined £5.

Stork Bros. Ltd.: For 6 minutes continuous emission of dark smoke. Pleaded guilty. Fined £5.

H. H. Seddon & Sons Ltd.: Mr. E. T. Mather, prosecuting, said that two Corporation officials kept observation on Messrs. Seddons' chimney and saw an aggregate of 24 mins. 32 sec. of dark smoke during a forty minute period.

Mr. J. D. Eaton Smith, defending, said that the firm had not been complacent in the matter and great efforts had been made, but smoke still came from the chimney. The firm had decided to spend £3,000 on conversion from coal to oil fuel. Fined £5.

James Haigh Ltd.: (Second summons). Mr. E. T. Mather said that observations of Messrs. Haighs' premises showed that black smoke was emitted for four and three-quarter minutes from their chimney. Mr. F. B. Webb, defending, said that his clients had been summoned in December, and since then a man with special qualifications had been engaged to try and stop the offence being committed again. "It is a matter of trial and error," he added. Fined £10.

Hammonds United Breweries Ltd.: Mr. Mather stated that the case against Hammonds Breweries related to their chimney at Lockwood, where observations showed two and half minutes of black smoke and then twelve and a half minutes of dark smoke. Mr. Eaton Smith, for defendants, said that every effort had been made to reduce the emission. " They realize that they will have to take effective steps to prevent emission, and they will have to introduce oil fuel. Firm after firm is going over to oil fuel burning systems, but oil fuel installation cannot be put in just at will." Fined £10.

Peter Conacher & Co. Ltd.: Mr. Mather said that observations at the Company's premises showed black smoke for three and a quarter minutes and then dark smoke for two and a quarter minutes. Mr. Webb commented that since the date of the offence the firm were now using coke, and it was therefore hoped that no further offence would be committed. Fined £10.

Fisher & Co. (Huddersfield) Ltd.: Dark smoke was seen to be emitted from the firm's chimney for six and a quarter minutes. Mr. L. Kelsey, defending, stated that the boiler fires had been allowed to get too low on the day of the offence.

Thomas Canby Ltd.: Mr. Mather said that dark smoke was seen to be emitted from the chimney continuously for nine minutes. Mr. Kelsey, defending, pleaded guilty on behalf of the firm and said that the smoke was caused by coal that formed a great deal of clinker, and thus required the fireman to open the boiler at frequent intervals. Fined £10.

Sections 1 and 3—Preston

The Trinidad Lake Asphalt Company (North Western) Ltd., were charged with emitting dark smoke and for installing a furnace without notifying the local authority. Mr. N. Sampson, public health inspector, said he had seen dark smoke being emitted from the plant several times and had mentioned it to the management and the workmen. His warnings were not immediately taken notice of in one case. Other times when the company were challenged they corrected the nuisance, often when they saw him approaching.

Mr. J. C. Richards, defending, said that his clients had to employ extra labour and keep up maximum production to complete road servicing contracts which had to be completed within a time limit. It was while the plant was working at full capacity that the offences occurred. The company, who pleaded guilty, were fined £5 for installing a furnace without giving notice to the local authority, and for four cases of emitting dark smoke £10 for each offence.

Section 1—Rochdale

Three out of four firms summoned at Rochdale Magistrates Court on March 9th pleaded guilty and were each fined £10. The fourth firm, Ensor Mill Ltd., pleaded not guilty and the case against them was dismissed. The firms which pleaded guilty were the Rochdale Carpet Co. Ltd., The Eagle Raising and Finishing Co. Ltd., and James Baron & Sons Ltd. The cases were brought as a result of observations made by Mr. W. D. Gartside, the Rochdale Smoke Inspector, who had seen smoke emitted in contravention of the Act.

Mr. Hague, defending, said that in the case of the Rochdale Carpet Company's Mill the offence was probably due to the human element—what one might probably call bad stoking. The fuel had now been changed. On behalf of the Eagle Raising & Finishing Co., Mr. Clegg said that the firm had been using a type of fuel other than that which was normally used. Mr. Hudson, for James Baron & Sons, said that the firm had called in expert advice, and it was thought that the trouble was caused by the segregation of fuel. The boiler was stoked mechanically and the installation was maintained in excellent condition. The matter of the fuel had since been rectified.

In the case of the Ensor Mill, where the boiler was oil-fired, Mr. Healy pointed out that it was a defence to a contravention of the Act if the contravention was due to some failure of the apparatus used. There had been a " stalling " of the pump supplying the fuel which had taken the day-shift fireman a few minutes to adjust, but the time take was not excessive. The equipment was extremely efficient and was regularly inspected by the National Industrial Fuel Efficiency Service.

Section 11—Glasgow

The first prosecution in Scotland to be brought under the Clean Air Act, was made at Glasgow Central Police Court on February 9th, when the maximum fine £10 was imposed on a firm for making too much smoke in the city's smoke control area. The firm, Ross's Dairies Ltd., pleaded guilty. The stipendiary magistrate commented that the Act had been in force for some time and it was time that some steps were taken to carry it out.

As well as being the first prosecution of its kind in Glasgow the charge was the last to be made by the city's senior smoke inspector, Mr. Thomas M. Ashford, who has retired after 37 years' service with the Corporation. Mr. Ashford was publicly thanked in court by the fiscal and the stipendiary magistrate for his services to the community.

Section 11—Rotherham

In the first prosecution of its kind in Rotherham a miner, Thomas Escreet, pleaded guilty to being the occupier of a house in a smoke control area from the kitchen and living room chimneys of which smoke was emitted. He was given an absolute discharge, and ordered to pay 8s. costs.

The chairman, Mr. J. H. Dickinson, said: " Because we are giving you an absolute discharge this morning, it does not mean that any future offences will be dealt with in this way, and we are issuing this warning that any transgression of this kind in the future will be dealt with in an appropriate manner."

Section 20—Hull

The owners of the tug *Bernie* were fined £20 on March 11th for permitting her to make smoke in excess of the periods allowed by the Clean Air Act. It was said that she emitted black smoke for 25 minutes in one half-hour period and later for another 10 minutes. For the defence, it was said that *Bernie* was stuck on the bottom and she was being stoked up to give her more power to get free.

ROAD TRAFFIC CASES

Hyde

So dense were the fumes emitted from a mobile crane that a policeman could not see across the road. On April 22nd the driver of the crane, Ronald Anderson, was fined £2 at Denton. The firm, Henry Chappell Ltd., was fined £3. In a letter to the court, it was stated that a screw on the fuel injection pump in the crane's engine had worked loose by vibration. When the screw was tightened the defect was remedied.

Bury St. Edmunds

For using a lorry at Barrow with excessive smoke being emitted from its engine, Eric Woolard, lorry driver, was fined £3 by Thingoe Magistrates on March 23rd. His employers, Messrs. BX Plastics Ltd., were fined £3 for causing excessive smoke to be emitted from the vehicle.

Leyland

Black smoke from the exhaust pipe of a van at Hutton caused inconvenience to pedestrians and other vehicles, Leyland magistrates were told on March 21st, when the driver, Joseph Carr, was fined £1 for driving a van which emitted excessive smoke. The vehicle owners, Keizer and Co. Ltd., were fined £3 for permitting.

Wilmslow

A lorry-driver, John Aked Hewitt, was charged before Wilmslow magistrates on March 3rd with emitting smoke from his lorry in a manner likely to cause danger. A Wilmslow police motor patrol driver, P.C. Derek Cheer, said that the smoke caused him to change down to second gear because of reduced visibility and to close his car windows. It was with some difficulty that he managed to overtake and stop the lorry. " A pall of blue smoke was hanging over the road, seriously reducing visibility," he said. A spokesman for the lorry owners told the police: " It was due to a mechanical device sticking." Hewitt was given an absolute discharge and the firm, H. and J. Quick's, were fined £2.

CHILD OF 4 SIGNED SMOKE PETITION

Not one of seven people who signed a petition against a smoke control order for the Carr Clough area of Prestwich attended at the public inquiry which was held at the Town Hall today.

And one of the signatories was a child of four

The Town Clerk, Mr. C. A. Cross, said he had hoped one or two would have attended to tell them the circumstances in which the petition came to be signed.

Urging that the objections had no relevance to local circumstances, he declared:

" How can it be said that a printed document drawn up perhaps in a London office and hawked about the country can be said to represent the mind of the signatories?

" This document is no more than a printed objection from some other interested party who has no right of audience in this chamber."

When Mr. Cross pointed out that one of the signatories was a child of four, his audience smiled as he added:

" It appears from correspondence that the father of this child is in favour of the order, so there must be some domestic conflict here."

Two others who had signed did not live in the area and it was significant that out of 475 householders who would be affected by the order there were only five objectors.

The enquiry was closed.—*Evening Chronicle*, *Manchester*, *April* 5*th*, 1960.

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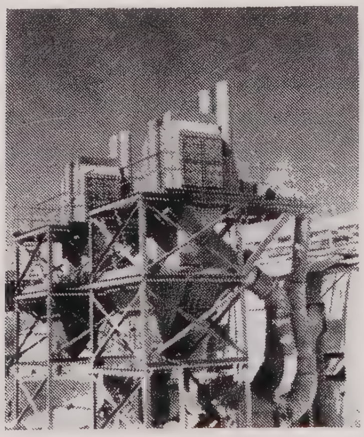

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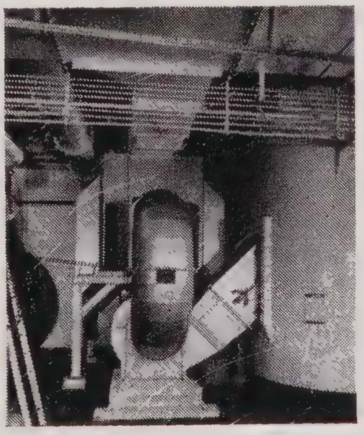

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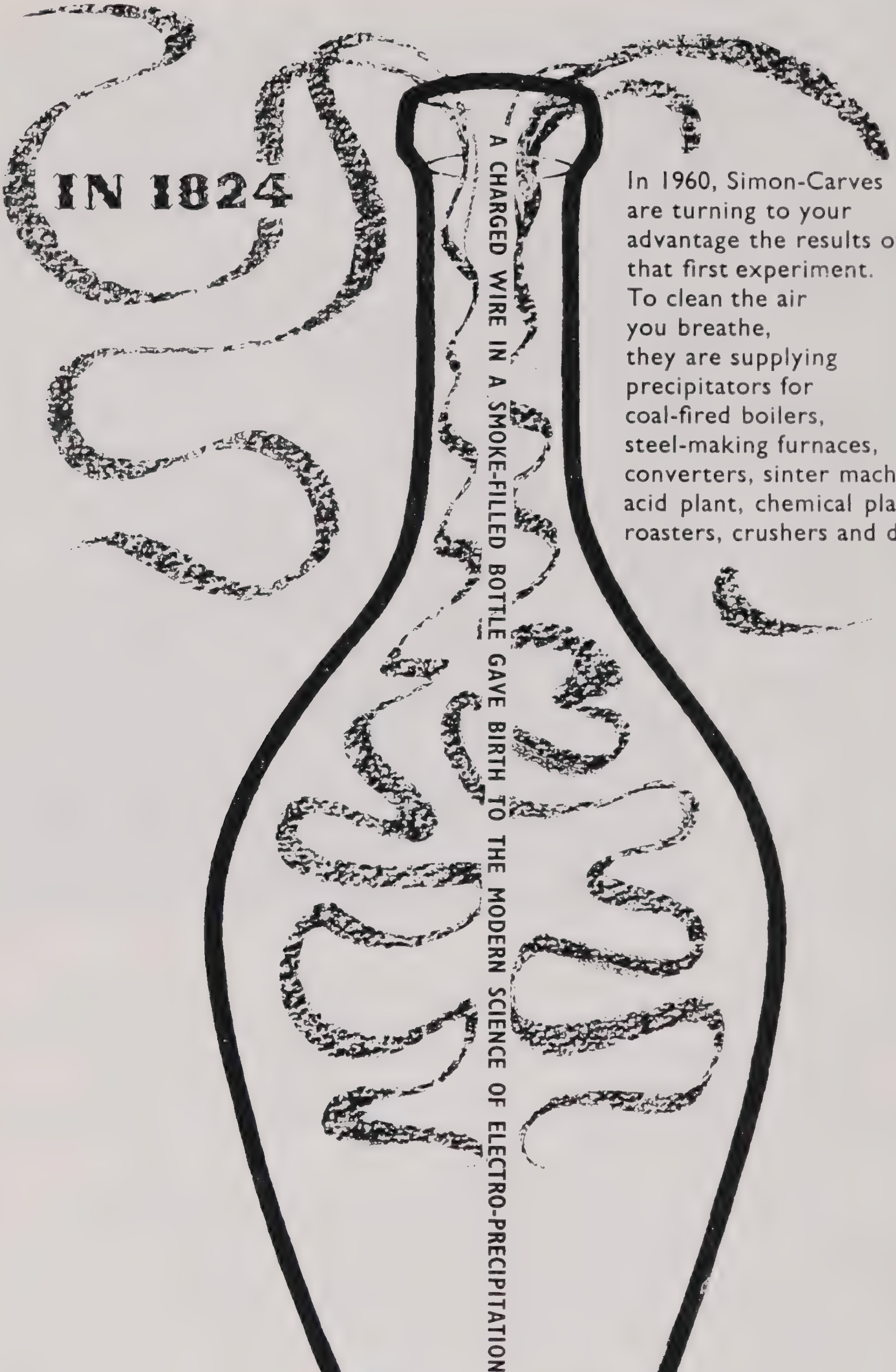
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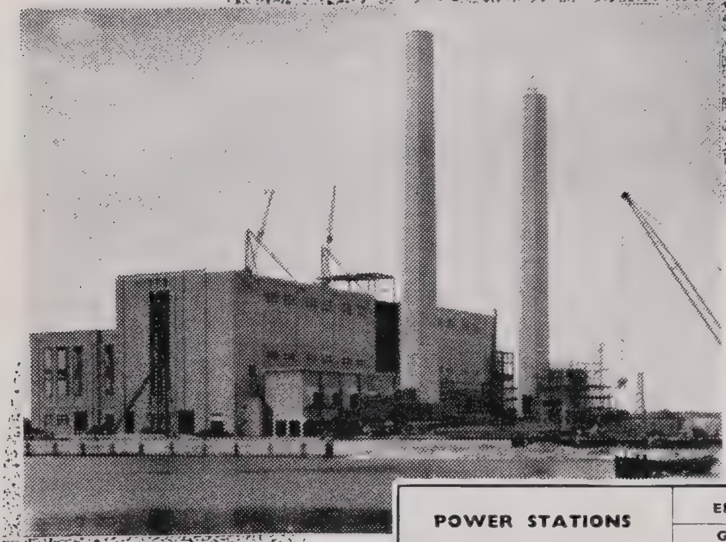

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